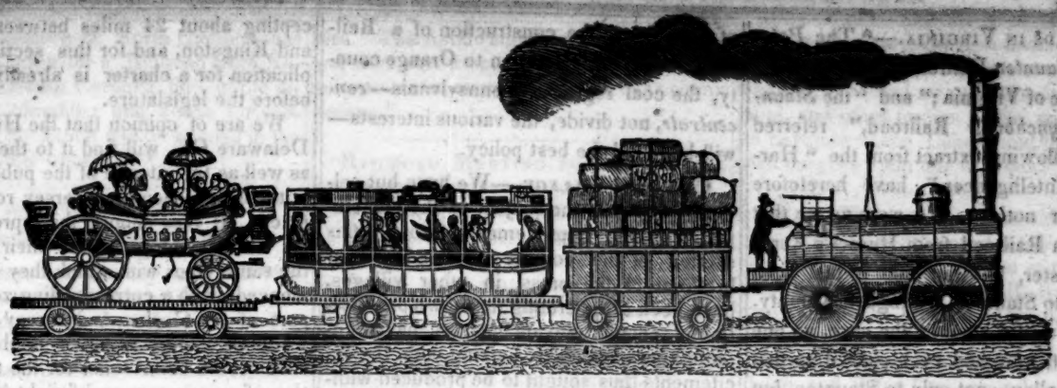

AMERICAN RAILROAD JOURNAL,
AND ADVOCATE OF INTERNAL IMPROVEMENTS.

PUBLISHED WEEKLY, AT NO. 132 NASSAU STREET, NEW-YORK, AT FIVE DOLLARS PER ANNUM, PAYABLE IN ADVANCE.

D. K MINOR, and GEORGE C. SCHAEFFER, } EDITORS AND PROPRIETORS.]

SATURDAY, MARCH 4, 1837. [VOLUME VI—No. 9.

CONTENTS:

Adver isements; Railroad and Canal Stocks. 129
Railroad Items..... 130
Notes on Indianna..... 132
Minutes of Evidence before a Select Committee of the House of Lords, on the Tolls on Steam Carriages' Bill. (Concluded.)..... 133
Introductory Lecture. (Continued.)..... 140
Advertisements..... 144

AMERICAN RAILROAD JOURNAL.

NEW-YORK, MARCH 4, 1837.

TO MANUFACTURERS OF HYDRAULIC CEMENT.

PROPOSALS will be received by the subscriber, on the part of the James River and Kanawka Companies, for the delivery on the wharf, at the city of Richmond, Va., of Fifty Thousand Bushels of Hydraulic Cement. The amount called for must be furnished in quantities of about six thousand bushels per month, commencing on the first of April, and ending on the first of November next.

To avoid future litigation, it is to be understood, on making the proposals, that the bushel shall weigh seventy pounds NETT, and that the Cement shall be delivered in good ordder, and packed in tight casks or barrels.

Proposals will also be received for furnishing fifty thousand bushels, at any convenient point on the navigable waters of James River, or the north branch of James River, where the materials for its manufacture has been discovered.

Persons familiar with the preparation of the Cement, would do well to examine the Counties of Rockbridge and Botetourt, with a view to the establishment of works for the supply of the western end of the line; and a contract for the above quantities will be made with them before they commence operations.

As there will be required on the line of the James River and Kanawka Improvement, in the course of the present and next year, not less than half a million of bushels of this Cement, and some hundred thousand bushels more in the progress of the work towards the west, contractors will find it to their interest to furnish the article on terms that lead to future engagements.

Proposals to be directed to the subscriber at Richmond, Va.

CHARLES ELLET, Jr,
Chief Engineer of the J. R. and Ka. Co.
February 20th, 1837. 9 6t

TO ENGINEERS.

WE are gratified to be able to announce to those desiring INSTRUMENTS, that Messrs. E. & G. W. BLUNT of this city, are now prepared to furnish at short notice, LEVELS, from different manufacturers, among others from Troughton & Sims, which they warrant of the first quality. Circumferentors, Levelling Staves, Prismatic Compasses, Mathematical Instruments, Books for Engineers, etc constantly on hand.

One of the above firm is now in England superintending the manufacture of Theodolites, Transit Instruments, etc.—and any orders for Instruments, not now on hand, will be forwarded him, and executed promptly.

*** Orders will be received and promptly attended to by the Editors of this Journal. 9 4t

RAILROAD AND CANAL STOCKS, in New-York and Philadelphia.

	Price of shares	Offered	Asked
SALES OF STOCK IN NEW-YORK February 27th.			
Mohawk Railroad	t w		88¼
Paterson Railroad			70¼
Boston and Providence	b 50 ds.		108¼
New-Jersey Trans.	60 ds.		108
Stonington	b 60 ds.		82
Long Island Railroad	n w		81¼
Paterson Railroad	b 90 ds.		75
Stonington Railroad	cash		77
Harlaem Railroad			78¼
Utica and Schenectady			121¼
Delaware and Hudson Canal			94¼
PHILADELPHIA STOCK MARKET. February 24th.			
RAILROAD STOCKS			
New-Castle and Frenchtown	25	31¼	32
Do loan, 5½ per cent	100	99	101
Wilmington and Susquehanna	50	38	42
Camden and Amboy, shares,	100	136	136½
Do loan, 6's 1836	100	110	120
Danville and P shares	50	25	35
Norristown, do	50	34	34½
Do 6 per cent loan	100	85	100
Valley Railroad	7½	1	3
Westchester do	50	20	28
Minehill do	50	55	60
N. L. and Penn. Tp. do	40	34½	35
Philadelphia and Trenton do	100	125	127
West Philadelphia Railroad	50	20	30
Harrisburg and Lancaster	50	46	48
Cumberland	25	15	20
Beaver and Meadow	50	57	58
MISCELLANEOUS STOCKS			
North American Coal Company	25	12	14
Steam Bt. Sts Columbian	100	18	22
Exchange Stock	100	70	80
Arcade	100	55	75
Theatres—Chestnut street	600	625	675
——— Walnut street	280	175	220
——— Arch street	500	325	375
Gas Company	100	100	109
CANAL STOCKS.			
Schuylkill Navigation, shares	50	164	164½
Do loans, 5 1845	100	98	100
Do do 1855	100	100	103
Do do 5½ 1837	100	98	100
Lehigh Coal and Navigation	50	85	88
Do loan, 6 1838	100	96½	97½
Do do 6 1839	100	97	99
Do do 6 1844	100	99	100
Do do 5 1840	100	96	97½
Union Canal, shares	200	180	190
Do loan, 1836	100	83	85
Do do 1840	100	85	90
Chesap'k & Delaware Canal, shares	200	20	40
Do loan, 1837	100	60	67
Do do 1840	100	60	67
Delaware and Hudson,	100	92½	93
Do loan	100	95	100
Louisville and Portland	100	112½	117
Convertible 6 per cent. loans,	100	110	120
Sandy and Bever	100	60	80
Morris Canal	100	99	100

LIST OF SUBSCRIBERS to the **Railroad Journal**, that have paid, (continued.)

J. Gibson, Goshen, Pa., Jan. 1, 1837
Wm. Norris, " " "
D. Ruggles, Newburgh, N. Y. " 1838
A. C. Morton, Goshen, N. Y. " "
S. B. Cushing, Providence, Rhode Island, January 1, 1838
D. Embree, Nashville, Tenn. Jan. 1, 1837
Philadelphia and Reading Railroad Company, Jannary 1, 1837
Wm Mathews, Covington, Pa. Jan. 1, 1838
Mr. Hoffman, Athens, Tenn. " "
Mr. Hayes, " " " "
E. McGehee, Woodville, Miss. " "
Major J. Johnson, " " " "
Judge Ogden, Baton Rouge, Louisiana, Jan. 1, 1838

We learn from a correspondent, that 60 miles of the Montgomery Railroad, Alabama, are under contract.

RAILROADS IN VIRGINIA.—"The *Potomac and Staunton Railroad*, now completed to the centre of Virginia;" and "the *Staunton and Lynchburg* Railroad," referred to in the following extract from the "Harrisburgh Intelligencer," have heretofore escaped our notice. We were aware that there was a Railroad from Harper's Ferry to Winchester, but not that it had been completed to Staunton, in Augusta County. That such would soon be the case, no one could doubt, who had ever passed up that beautiful Valley—not only to Staunton, but also to Lexington, Firecastle, and Abingdon, and thence to *Tennessee*—but a Railroad from *Staunton* to *Lynchburg* would, we should imagine, be no easy matter, unless it were to continue up the Valley to Lexington, and then follow the north branch of James River through the Blue Ridge. Will some of our readers put us right in this matter? We seek information in relation to this road.

[From the Harrisburg Intelligencer.

A LINE OF RAILROADS FROM PHILADELPHIA TO NEW-ORLEANS.—It is not generally known, that companies have been incorporated for the construction of a continuous line of Railroads from Philadelphia to New-Orleans, through the great Cumberland valley. But such is the fact, and a part of the chain is already completed.—The Philadelphia and Columbia Railroad, and the Cumberland Valley Railroad from Harrisburg to Chambersburg, are now finished or under contract. The Franklin Railroad to connect Chambersburg with Harper's Ferry, will connect the foregoing Pennsylvania works with the Potomac and Staunton Railroad, now completed to the centre of Virginia: the Staunton and Lynchburg Railroad: the Lynchburg and Tennessee Railroad—to connect the Virginia works with the Nashville and New-Orleans Railroad—will complete the chain, and form a direct communication between Philadelphia and New-Orleans, by Railroads, without inclined planes, on which locomotives can be used the whole distance. What a splendid improvement!—We are pleased to see that a committee of the Virginia Legislature has recommended that the State appropriate out of the Surplus Revenue, 600,000 dollars to the Potomac and Staunton Railroad—450,000 dollars to the Staunton and Lynchburg Railroad—and 1,255,000 dollars to the Lynchburg and Tennessee Railroad. Should the Old Dominion follow the recommendation of this committee, we shall have a continuous Railroad to New-Orleans within five years.

We copy the annexed article from the Goshen Democrat, and most cheerfully unite with the Editor of that paper, in the expression of the opinion that the Hudson and Delaware Railroad Company, will find it for their interest to unite with the citizens of Goshen, in the construction of a Railroad, which shall lay open to Orange county, the coal region of Pennsylvania—*concentrate*, not divide, the various interests—will be found the best policy.

OUR OWN VILLAGE.—We have but seldom referred to the subject of the contemplated public improvements through this section of the country, and whilst our brethren of the press, in other villages, have been exaggerating their own prosperity and peculiar advantages, we have contented ourselves with looking upon the excitements thus sought to be produced without participating in them or following their example thus set, so far as it regards us, and we have even abstained from repelling insinuations and statements hostile to our village and its interests, contained in such publications. Whatever may have been our anxieties or doubts heretofore, we have now the pleasure to state, from information derived from authentic sources, that little or no doubt remains upon the location of the New-York and Erie Railroad, through our village, although long persuaded from a careful examination of the subject that such was the preferable route, so far as the interests of the company and the public were to be regarded. We regret the efforts which have been made to divert it from us, but we congratulate the citizens of our village, upon the probable success of their exertions in the resistance of those efforts. We hope to be able soon to assure our readers as to the final decision of the company on the above subject. But for the present, we only call the attention of the public to the advantage of our location, by adverting to the projected additional improvements which must doubtless intersect the New-York and Erie Railroad in this village.

The importance of the Goshen and Jersey Railroad which is designed to connect with the New-York and Erie Railroad at this place is not generally understood. The engineers have completed the survey to the Jersey line, and report that the route is not only a feasible one but of the best in this section of country, the greater part of it being nearly a perfect level, and the highest grade not exceeding 20 feet in a mile. The engineers are continuing the survey to Columbia, N. J., and we learn that so far as they have gone the route is highly favorable. This road is intended to connect with others leading to the coal regions of Pennsylvania, and the western part of that State. Beside this, it is confidently believed that the road for which a charter has been obtained, from Kingston to the Erie road, will be constructed through the valley of the Walkill, and terminate at this place. This would form a continuous line of railroad from Buffalo, by the route of the canal, to Canojoharie, thence by way of the Canojoharie and Catskill road to Catskill, thence by way of Kingston and this village, where it would intersect the New-York and Erie road, to the city of New-York. For the whole of this route charters have been obtained, (some portions being already completed and others under contract) excepting about 24 miles between Catskill and Kingston, and for this section an application for a charter is already pending before the legislature.

We are of opinion that the Hudson and Delaware Co., will find it to their interest, as well as the interest of the public to unite with the Goshen and Jersey road, at this place. If they should think proper to do so, and should prosecute their work with the same vigor with which they have commenced, with a corresponding zeal on the part of the Goshen and Jersey Company, we think there can be no doubt that the roads could be in order for the transportation of passengers and freight in less than two years when coal from Pennsylvania mines could be delivered in this village for four dollars per ton., and in Newburgh for less than five dollars per ton.

We might fill columns with the important advantages which would result from these contemplated improvements, but we have neither time nor space at present; we shall resume the subject hereafter.

From the Petersburgh Intelligencer.

RALEIGH AND GASTON RAILROAD.

It gives us much satisfaction to learn that this work is in rapid progress, and bids fair to be completed with as much despatch as any that has preceded it.

One half of the whole line of the Road, from Gaston to Chalk level, a distance of about 45 miles had been located and put under contract. Between 600 and 700 hands are at work, and although only five weeks have elapsed since a commencement was made, the extent of excavation and embankment is already considerable.

Exclusive of several contractors who have heretofore been regularly engaged in this occupation, some of the most wealthy and respectable planters residing in that part of the country have taken contracts, and are making excavations and embankments instead of Tobacco and Cotton—looking forward to the benefit which they will derive in the transportation of future crops to market, when the Railroad shall be completed, which will no doubt precede the maturity of their next years crop. The owners of Land, on and near the line of the Road, find a new resource in the market which it affords for their timber, heretofore of little or no value—for provisions of all sorts, and for any superfluous labor from the business of farming. Most of the foundations of the piers and abutments for the Bridge across Roanoke are above high water mark, and that great work will be speedily executed.

The Road has been located as far as Tar River, and will soon be completed to Raleigh. Persons are in readiness to take contracts on this half of the Road, and there is no doubt that the entire line will be let, very soon after the requisite preparations are made by the Engineers.

A spirit of activity, we understand, prevails along the whole extent of the country through which the road is to pass, and all look forward with confidence to the benefits which it will confer.

The Legislature of North Carolina has granted a Charter for a Railroad from Raleigh to the South Carolina line, in the direction to Columbia; and books for subscription to the Stock will be opened in the course of a few weeks.

From the Newark Daily Advertiser.

BELVIDERE DELAWARE RAILROAD.

Our readers are already informed that the Legislature granted banking privileges to this Company on the 7th instant. We give below a summary of the Supplement to the Charter, which confers the privilege. The Directors, we learn, have determined to locate the bank within two miles of the Delaware bridge at Easton—as near that place as is practicable. I. M. Sherrerd, Esq., who resides at Belvidere, has resigned the office of Secretary in favor of Charles Sitgreaves, Esq., and accepted that of Counsellor of the Company.

Messrs. Col. Porter, Dr. Green, and Duckworth have been charged with the duty of Commissioners for the disposal of the stock, receiving proposals for a banking house, depots, &c. A survey and estimate of the road will be made at the earliest possible period by the Company's Engineer, Mr. Edwin A. Douglass. The whole enterprise, it is believed, will be completed within two years.

The Supplements provides—

1st. The Company is authorised to increase its stock to any amount not exceeding $500,000—the original privilege being limited to a million.

2nd. To employ any part of the whole stock, not exceeding $500,000 in Banking purposes; the bank being located in Greenwich, Warren County, N. J., and its operations not to commence until the road is located and under contract; 20 per cent. of the Capital paid in, and $100,000 expended on the road, and then whenever another equal sum shall be so expended, the like amount is authorized to the added to the banking capital, until the aggregate shall amount to $500,000. The bank privilege ceases if the whole stock is not paid in within 10 years.

3rd. The banking capital is made liable to the present or any future tax, and the railroad, and all other property of the corporation, is liable for the bank, besides the Directors being personally responsible.—The cashier and a majority of the directors to be residents of New-Jersey, and the President to be a citizen of this State or of Northampton, Pa.

4th. The usual powers and restrictions put into bank charters are contained, and the duration of the charter is limited to 21 years from the time allowed by the original act for completing the road, which expires on the 4th of July, 1846, so that the charter continues until the 4th of July, 1867, or upwards of thirty years. The Railroad charter is perpetual.

The intelligence of the passage of this bill, we learn by the Belvidere Apollo, produced universal satisfaction, which was manifested by the reports of cannon, loud cheers, and uncorking of champaigne bottles. The Apollo significantly adds—"For our own part we can rejoice over a bumper of pure water as cheerfully as over champaigne."

Railroad Meeting for a Railroad between Newport and Boston, via Taunton.—A meeting of citizens was held at Newport, the 18th instant, to take into consideration the expediency of making a *Railroad* from that place to Taunton; there to connect with the Railroad running thence to Boston.

At said meeting, committees were appointed for the following purposes, viz:

1. To ascertain and report upon, the practicability of constructing the contemplated road, reference being had to the several modes of construction now in use, with the estimate of the cost of each, &c.

2. To report upon the sources whence the proposed road may derive an income sufficient to pay a fair and certain profit to its stockholders: on the presumable advantages to be derived by the various interests of Agriculture, Commerce, Manufactures, and general intercourse, &c.

3. To report upon the importance and validity of the road, in a national and military point of view, and in reference to the establishment of a Naval Depot, Arsenal, and Foundry by Government.

4. To correspond with the Merchants, Manufacturers, Steamboat Companies, Capitalists, and others interested, in New-York, Providence, Boston, and elsewhere, to invite delegates from these places to attend a general Convention at Newport, and to collect and publish such facts relative to this important enterprise, from time to time, as they may deem advisable, and report their doings to the General Convention.

5. To report upon the necessary measures for procuring a charter, and for uniting with the present incorporated companies.

New Harbor at Cleaveland.—A writer in the Cleaveland Daily Herald, is endeavoring to demonstrate the practicability of forming a new harbor in front of that city, by the construction of a pier or breakwater of 7000 feet in length, at a distance of about 1000 feet from the shore at low water. He proposes to wharf out for 450 feet of this distance, at which point there is 10 feet water—the location of the pier to be in 15 feet water. He estimates the expense of the improvement at $175,000, and contends that the enhanced value of real estate to be benefitted by it, will amply defray the entire cost, both of the pier, and of the wharfing which would be required. The positions of the writer are however contradicted by another correspondent, who asserts that the undertaking will be enormously expensive, and is entirely impracticable.

One idea put forth by the writer who urges the improvement, may perhaps be deemed a little fanciful. He says:

"The contemplated Ship Canal around the Falls of Niagara, which will result in a line of uninterrupted ship navigation between this city and the Atlantic ocean, presents a strong argument in favor of the new harbor. Before the present generation shall have passed away, ships from Liverpool, and other foreign ports, will be seen to navigate these Lakes, and unlade their rich cargoes upon our wharves!"

The Middlesex and Monmouth Railroad was organized at Freehold on the 12th inst. by the election of the following directors, viz: Daniel B. Ryall, William L. Dayton, Geo. C. Herron, Isaac K. Lippincott, Simon Arrowsmith, John H. Smock, William Little, Joseph F. Randolph, and Peter Vredenburgh.

At a subsequent meeting of the Directors, Daniel B. Ryall was elected President; William L. Dayton, Treasurer, and P. Vredenburgh, Secretary.

The Princeton Whig says, "The whole of the stock is now subscribed for, and active preparations are making to proceed with this highly useful and important work. One gentleman from the South, we learn, has offered to make the whole road, so certain is he that it will be a profitable investment. But the directors prefer keeping it according to the original intention, in the hands of the farmers in its vicinity, for their more immediate benefit."

A Compromise.—A Gettysburg paper says: "We are gratified in being able to state, that the Wrightsville and Gettysburg Railroad Company, and the Wrightsville and York Company have compromised, and that there will be but one road and joint stock between this place and Wrightsville. A bill for the consolidation of the companies is now before the Legislature, and will no doubt pass."

Geological Survey of Michigan.—This bill has become a law. It is entitled to rank among the most important that have engaged the attention of the Legislature of Michigan. The expense of the survey is too trifling to be compared with its benefits. The whole is less than that of the Toledo campaigns, and it is distributed over four years—$3000 are appropriated for 1837, $6000 for 1838, $9000 for 1839, and $12000 for 1840.

Wrightsville and York Railroad. At an election for Directors of the Wrightsville and York Railroad Company, held at York on Monday last, James Howard, Luke Tiernan, John H. Hodges, and James Harwood, of Baltimore, Thomas McGrath, and Edward Chapin, of York, and James E. Mifflin, of Wrightsville, were elected Directors, to serve for the ensuing year.—[Baltimore Gazette.]

Silver Creek and Dunkirk Harbors.—The Hon. Mr. Sutherland, Chairman of the Committee on Commerce, has presented to Congress the Annual Report of the Committee. By the Report it appears, that the sum of *four thousand five hundred dollars* is reported for the erection of a beacon light at Silver Creek harbor; and that Dunkirk harbor has a report of

two thousand seven hundred dollars for a like purpose. The Delaware Breakwater, or general harbor appropriation bill has not yet been presented.—[Dunkirk Beacon.]

A memorial has been presented to the Legislature of Pennsylvania, from WILLIAM NORRIS, Engineer and Machinist, of Philadelphia, in which he proposes to take charge of the motive power on the Columbia and Philadelphia Railroad, for the term of three years. He engages to keep the stationary and locomotive engines, now on the road, in perfect repair, and to conduct the transportation of passengers and freight, at all seasons of the year, without delay, and to receive as compensation for these services, the tolls which shall be collected from the motive power.

We give the following "Notes on Indiana," believing that they will be found highly interesting to many of our readers.

From the Springfield Ohio Pioneer.

NOTES ON INDIANA.

MR. EDITOR,—Having recently returned from a visit through the Northern part of Indiana, and thinking that a few hurried remarks upon that country might not prove uninteresting to some of your readers, I submit the following particulars.

After having made a voyage across the ocean of swamps, extending in width from St. Mary's, Ohio, to Fort Wayne, a distance of sixty miles, we reached the latter place, the country seat of Allen county, Indiana, situated on the east bank of the Maumee river, where the river is formed by the junction of the Little St. Joseph's and St. Mary's rivers, and immediately on the ground where Wayne's fortification against the Indians stood, from whence it derived its name. The population is about 1000: half of which are French and Canadians. The public buildings are a court-house, jail, and three churches: it has a bank and a library. The land office is kept here. The river is navigable for barges and keel boats; and lately a small steamboat ascended as high up as this place; and from this may be dated a new era of its prosperity. The Wabash and Erie canal passes through this place: twenty-five miles of it is furnished from here to Huntington, and affords an extensive water power at this place. In short, Fort Wayne is situated in the midst of a rich and fertile country, which, together with its other local advantages, must make it in a few years become a thriving and populous city.

After crossing the rich and fertile counties of Noble and Elkhart, with their many advantages, in a North Western direction, we came into the county of St. Joseph.—South Bend, the county seat, is beautifully situated on the south bank of the Great St. Joseph's river, upon a sandy plain elevated about 25 or 30 feet above high water mark; and contains a population of about 1000; and perhaps is not excelled by any town in the North for beauty of situation. It has attained its present importance and beauty by its superior local advantages. Its growth though rapid, has been steady, and corresponding with the improvement of the surrounding country. The town plat was laid off into lots, and brought into market between five and six years ago: a more eligible site could not have been found in all Northern Indiana. Travellers are charmed with its beauty, and upon learning its superior local advantages are at once struck with the conviction, that it must and will, in a very short period of years, become a town of some five or ten thousand inhabitants. The St. Joseph's river, opposite the town, is about two hundred yards in width: it is a deep and majestic stream, and is navigable for steamboats as far up as South Bend, and even further, except when locked up by the frosts of winter. Its course is generally North-West, and a more beautiful and imposing stream was never gazed upon by man. Just opposite the town there is a fine fall in the river, which when properly improved will afford a most tremendous water power. A company of enterprising men are now improving it by cutting a race with a lock for boats to pass through, and furnishing materials for damming the river. It is calculated that a power will be brought under control sufficient to propel from fifty to a hundred run of mill stones. This vast power will be immediately thrown into market: it will immediately arrest the attention of enterprising capitalists, and will, without doubt, all be employed in propelling various kinds of machinery in a very few years. Besides this vast power, there is a race discharging the waters of the Kankakee river into the St Joseph's on the town plat, affording a volume of water sufficient to propel from ten to twenty run of mill stones. There may be some estimate of the power afforded by this improvement when it is made known that the proprietors have been offered the sum of thirty thousand dollars: the whole improvement perhaps not costing more than three thousand dollars. And here are the waters of the South united with the North—the Lankakee river emptying into the Illinois river, and the St. Joseph discharging its waters into the Michigan lake. Thus water, that was intended by nature to flow into the Gulf of Mexico is, by a little labor, made to flow into the Gulf of the St. Lawrence.

A canal is located through South Bend from Michigan city on Lake Michigan, to intersect the Wabash and Erie canal at Fort Wayne; and it will in all probability be put under contract the ensuing summer. The Michigan road—a graded road—extending from Madison, on the Ohio river, to Michigan city, passes through South Bend. This, it will be readily seen, is an important road; it being the greatest thoroughfare through the centre of the State, from South to North; and towns through which it passes in the interior may boast of it as being a matter of no minor importance. At no distant day, a railroad perhaps from some point on Lake Erie, directly through South Bend, to Michigan city, and thence, in course of time, west to the Mississippi river will be constructed. The project is under way, and the combined enterprise and capital east and west will be enlisted for its prosecution. By reference to maps it will be seen that this railroad must pass directly through South Bend.

The Kankakee river may, with trifling expense, be rendered navigable for steamboats within twelve miles of South Bend. A canal across these twelve miles, will open to South Bend a water communication with the great Mississippi river, and its vast and extensive commerce.

The town is remarkably healthy, and the land of the country around it, is like most of the land in the northern part of the State—open oak and some heavily timbered land, prairies, and low lands.

The soil is of a sandy nature, but mixed with a sufficient quantity of marl and iron, which renders it productive, and is a guaranty of its durability.

The county of St. Josephs, though but six years ago an untamed wilderness, the undisputed wild and uncultivated home of the savage, now contains a population of from five to six thousand enlightened and industrious farmers, and abounds with numerous well tilled, extensive, and productive farms. Possessing such advantages, it is not a matter of wonder that South Bend should have assumed her place among the populous and flourishing towns of the North. It contains two churches, a printing press, from which issues weekly the "South Bend Free Press," a public library, fifteen dry goods stores, and two drug stores; three taverns and four groceries; four lawyers, three physicians, and mechanics of almost all the branches of the mechanic arts; there are, also several week day schools, two sabbath schools, a temperance society, and a lyceum, &c. &c.

About four miles from South Bend up the river, on the same side, is a village by the name of Mishawaka, containing a population of about three hundred souls. It possesses many advantages, and among others, inexhaustible beds of iron ore near it, which is going to be worked by a company of enterprising capitalists, during the ensuing spring. They are making hasty arrangements for a furnace, rolling mill, &c., and they have already in operation an extensive iron foundry, a flouring mill, and many other kinds of machinery. There are several large dry goods stores in this little village.

The next places that arrest the eye of the traveller, are Laporte and Michigan city, both of which are situated in Laporte county. The town of Laporte, the county seat, is situated near the centre of the county, on the south bank of a beautiful clear lake, of about a mile square; it is bounded on the east, south, and west, by extensive and beautiful dry prairies, and natural meadows, which are mostly all fenced and under cultivation, and dotted over with farm houses. On the south-west, the scenery is beautiful in the extreme, there being no forest or in exceptance of the view, till the horizon and the earth seem to close. Nothing can be more charming than a view of this in autumn, when the sun is declining in the west with all the splendor of an autumn afternoon. Laporte has a population of from five to seven hundred. Its public buildings are a court house, a jail, and two or three churches; it has also, a library and a printing press, from which is issued weekly the Laporte Herald. The land office for the Laporte district is kept at this place.

Michigan city is twelve miles from Laporte, and situated on the shore of Lake

Michigan, from whence it derived its name. The ground upon which it stands, is very sandy, and uneven, consisting of hills of loose, yellow sand, which was at one day all occupied or covered by the lake water, but the waves have through time thrown up these sandy barriers and caused the Lake to recede for several hundred yards. The population is perhaps about a thousand, who are mostly emigrants from the State of New-York. Its advantages consist entirely in its being a landing place for vessels of merchandise for the interior part of the State. There is no harbor as yet at this place, but the citizens are making arrangements for constructing one the ensuing summer. The country immediately around is mostly broken, and of a poor sandy soil, covered mostly with white pine timber, which affords excellent building timber. It is not more than three or four years since this place was laid out. Its growth has been very rapid, and bids fair to become one of the foremost of the towns on the lake.

Much more might be said of the rapid growth and prosperity of Indiana; but having already lengthened this longer than I first intended for a newspaper arricle, it is sufficient to say that in a very few years Indiana will assume a place in the formost rank of her sister States. H.

From the London Mechanics' Magazine.

MINUTES OF EVIDENCE BEFORE A SELECT COMMITTEE OF THE HOUSE OF LORDS ON THE TOLLS ON STEAM CARRIAGES' BILL. SESSION 1836.

Do you consider that safe?—It is just the same as one we made as it regards the boiler, and the mechanism very similar.

You consider yours safe of course?—It is quite safe from explosion.

But is it safe in other respects; is it safe to travel along the road with?—Yes.

Not only for the persons travelling, but for the persons it meets?—All carriages going at great velocities make more noise, and are consequently more likely to frighten horses.

Do you think they are as safe to meet as a mail-coach?—Until horses are more accustomed to them.

You think there might be considerable anger at times from horses taking fright?

Could you make a gauze sufficiently close to keep a draught, and prevent the smallest sparks escaping?—That object can be attained only by increasing the gauze head to such extent that the sum of all the openings in the wire shall be equal to the area necessary for the draft.

But do you think that object has been attained?—I do not know that it has.

Part of Hancock's plan is the one adopted on railroads also; to turn the steam into the chimney to create a draught?—I rather think he turns the steam into the ash-pit, and so lets it pass with the air through the fire.

And then it goes up the chimney?—I am not fully acquainted with the construction of it.

You say you think danger would attend the use of steam carriages till the horses were accustomed to it; at the same time you say, when you travelled by Hancock's along the New-road, there was no appearance of the horses being frightened?—No, there was not; and I think the noise and the smoke might be very much abated if it became a general thing. In the experiments I have been mostly engaged in, that has not been so much an object as to produce the effect.

What legislative provisions would you —Yes; from this as well as from any other cause.

How would the effect of them be at night, as far as you can judge?—At night the flame and the sparks are an objection; improvements may obviate this.

They are visible?—Yes, at night, when coal is used; less if coke is used, as is the case with Hancock's and some others.

You never saw it?—No; but from the manner in which Hancock's flame is divided and the heat absorbed, I should think it likely that less flame would be visible.

Do you think his plan, as far as you can judge of it, would secure you from sparks falling in the road?—I think it might be lessened in every construction by a gauze at the top.

Are you of opinion that gauze at the top is an effectual remedy against the emission of sparks from locomotive engines?—Not the smallest sparks perhaps, but the largest, certainly.

That would apply in the same way to Mr. Hancock's?—Yes, just the same.

suggest to enforce a due attention to that object?—I am not prepared to suggest any.

What would be the mode of doing it that would occur to you to induce engineers to turn their attention to that point?—Any thing that would induce or oblige them to lessen the noise, flame, and sparks.

With regard to the smell, is there not a great effluvia arising from Hancock's carriage?—I have understood there is: I did not perceive it.

When you were travelling along by it you did not perceive it?—No.

What is it from?—It is from the steam passing through the fire, and the products of the coke.

Have you any opinion of the size that it would be desirable that the boilers to run along high roads should be allowed?—I think it difficult to prescribe a rule of that kind.

Do you think it possible in any case danger could arise from a boiler that is cylindrical, of which the diameter was not more than ten inches, supposing it were to burst?—If it exploded, even that diameter would produce mischief to those who were near it.

The notion is to divide the boilers into chambers, and the chambers should not exceed ten inches in diameter; do you think danger would arise from the bursting of that?—I should be afraid to stand near one when it exploded.

Can you state that size of the chamber which, if it was to explode, would not be dangerous?—I should think any chamber exploding beyond three inches in diameter would be dangerous.

Below that you think no serious harm could arise?—No; it would rend, and let the steam out.

Do you find it very difficult to get men capable of managing locomotive engines on roads or on railroads?—There has been so little experience hitherto that we have always trusted the carriage to one steersman, who is very expert, and have never had any accident. He is a man formerly in the employ of Sir Charles Dance, and who came to us from him. I have travelled some hundred miles with carriages which he has steered, and he has in no instance met with an accident.

What carriages were those?—It was the old carriage of Sir Charles Dance's and that made by us.

You have been many hundred miles on that?—Yes; and that we made last summer.

As you probably employ a great number of men of that class, do you think there are many men capable of conducting a steam carriage?—I think every coachman would be able to steer well with practice.

You mean a good coachman could conduct a steam carriage?—Yes.

And your engineers, you must have an engineer with your carriage besides?—Yes.

Is that a class of men you can easily find?—Yes.

And capable of doing it?—Yes, very easily.

Is there any such nicety in the work that if they were to get drunk, or take too much, they would be liable to accident?—Not more so than on a railway, or a locomotive engine, or a steamboat.

But on a railway the locomotive-engine could not have the opportunity of stopping at different public-houses?—Certainly not.

Therefore there would not be the same probability of a man getting drunk?—The steersman may be considered exactly the same as a stage-coachman in that respect, all depends upon his care.

You think there would be no more risk from a drunken engineer than from a drunken coachman?—They are much the same.

There would be no more danger arising from the misconduct in that way of an engineer than from that of a coachman?—No; I think not.

And that the engine is not a more dangerous vehicle to be conducted?—No.

Within what space could you stop your engine that you went to Reading in, going at the rate of twelve or thirteen miles an hour?—In about the space a coach would stop.

Three or four yards?—Yes.

It was in Sir Charles Dance's you travelled so far, and is that as easily stopped?—I spoke of that, and the carriage we made.

And would it turn as easily?—Yes.

Would it turn as easily as a stage-coach to get out of the way?—Quite so.

Could yours?—Quite so.

And does Hancock's?—It is quite as manageable as a stage-coach.

Do you think it desirable on high roads to have drags for other carriages, or to carry the passengers on the engine itself?—I should think passengers would be more comfortable in a separate carriage.

Which would be the safest for the public?—A separate carriage.

Do you not think that the length of the carriage on the road would be a serious inconvenience, and be attended with consider

able danger?—It is not longer than a coach and four horses altogether, with the drag.

Would you think it dangerous that a carriage of the length of one of the great timber waggons that you see should travel on the high-road at a great speed?—Extending the length beyond certain limits would increase the danger.

You think it would be desirable that that length should not be extended?—The shorter it is the better.

Do you think it would be desirable to have any mode of testing the boiler of steam carriages?—I think they should be tested.

You, of course, use some mode of testing them before you send them out of your factory?—Yes.

Would there be any means of enforcing such a test to prevent neglect on the part of engineers, to prevent mere adventurers?—I think it might be done.

How could it be done entirely?—By forcing them with water. It would require some officer to examine and to see them tested.

Is there any difficulty in the use of the instrument you use to test them to require a scientific person to apply it?—Not at all.

Any individual might do so?—Every carriage has a hand-pump, which is an instrument by which the boiler might any time be proved. The pump which fills the boiler before starting, or in case of the water being short, that pump is the most appropriate instrument for proving the boiler; so that if the safety valve was weighted to double the extent at which it was determined the boiler should work, it might be proved at any time.

Might it be proved, suppose the Legislature required that the boilers should be tested before a magistrate, would he be capable of seeing the test was correctly applied, or does it require a scientific person to do it?—It requires a scientific person, or it might be evaded.

Is there any means to be adopted by which such a test shou'd not be evaded?—I can suggest no other than that of a qualified person to superintend it.

What do you think might be the test of a boiler; how many times the pressure that is intended?—I should say double.

You think that sufficient?—Yes.

What test do you generally adopt in your boilers?—Our boiler was so strong that it would have borne five times the pressure we worked it at, so that we were free from any apprehension of explosion.

But with boilers generally you know to what pressure it is intended to subject them. and you subject them to a test?—Boilers having to sustain great pressure are tested double.

When you make high pressure engines you must test them?—Yes; to double the pressure intended to be used.

You think double the pressure required would be sufficient?—Yes, I think it would.

If there were a provision that it should not be lawful to use any vessel to propel a carriage any part of the transverse section of which should not exceed ten inches circular or cylindrical—you think that is too large an allowance—do you think that would not secure safety to the passengers?—It would certainly be dangerous to passengers if it should explode.

But if it is properly tested there is a security against explosion?—It would be safe if t were made sufficiently strong and tested.

If it were not made sufficiently strong it would not stand the test?—No.

If it does stand the test, you think there would be no danger in that?—No; making allowance for decay.

You say you knew the principle of Gurney's mechanism, and you thought it safe? Yes.

Was not that the principle of his chambers—of his boilers?—The cylindrical vessels were considered safe, but the square flat vessels which he used at one time I did not consider safe.

But the cylindrical were his patent?—I do not know what his patent is.

Though a vessel may have been tested and pronounced to be safe, yet is it not possible that it may be used for too great a time, and that danger may arise from that circumstance?—Certainly it is.

Can there be any limit fairly put as to time without doing injustice?—I think no limit could be set as to time, for a boiler may be as much injured in one day, and its strength impaired by accident, as in ordinary wear it would be in twelve months.

The test is only a guarantee of safety at the time it is applied?—Exactly so.

These chambers may be perfectly safe at one moment, without any appearance of danger, and may burst the next?—It is quite possible.

I do not know if you are of opinion that a small chamber, though it should burst, would not produce any disastrous consequences?—I am perfectly aware of that. Indeed the boiler used in the experiment in which I have been engaged is one of which Sir Charles Dance, in conjunction with myself, has a patent, the principal feature of which is, that no part of the boiler exposed to the pressure of the steam should exceed three inches in diameter, and therefore may be considered perfectly free from danger from explosion under any circumstances with any degree of wear, so as to remove entirely the apprehension of any danger to the passengers from the explosion of the boilers.

MR. BENJAMIN W. HORNE, COACH PROPRIETOR.

There is a great hostility among coach proprietors to steam-carriages, is there not?—Not at all. If we should prefer either, we should prefer those on the high road to those on the railroad, for the competition is greater. I speak with a degree of honesty.

What weight do you require a horse should draw in a stage-coach, a coach fairly loaded?—They so much vary; from two to three tons.

In your own establishment what do you calculate the weight of the fast coaches when loaded?—About two tons; not exceeding.

You have some coaches faster than others? The difference of about three miles an hour.

The fastest go about ten miles an hour?—Eleven.

What is the full weight of a loaded coach going at the rate of eleven miles an hour?—Not exceeding two tons.

What is the full weight of a loaded coach that does not go more than eight miles an hour?—They are short coaches that go merely to Dorking, Sundridge, and Egham; they do not go at the rapid speed, as others do.

Have you any that go eight miles?—All distances.

Have you any eight mile an hour coaches?—Yes, a Dorking coach that goes eight or nine miles an hour.

What is the weight of that loaded coach more than the others?—It is the same as one that travels from 70 to 100 miles; it is the day and night.

The day coach does not exceed two tons; About that.

What is the weight of a night coach?—It might be perhaps occasionally according to the season of the year; if it is a mercantile town it varies; it is occasionally half a ton more; two tons and a half.

What rate would that coach go?—Nearly ten miles an hour.

Do you horse any vans?—No.

Do you run to Norwich?—Yes.

Does that come up loaded with turkeys at Christmas time?—Yes.

What is the weight of it?—When we have turkeys there is hardly any passengers; scarcely any difference; it might weigh three tons; hardly that.

You require about five hundred weight as the load of each horse?—About that.

How many miles do you reckon that a horse ought to go at the rate of e'even miles an hour, drawing five hundred weight, per diem.—About eight miles.

Does the same horse do eight miles seven days in the week?—If it exceeds ten there is another horse kept, which brings it down fifty-six,and he will go fifty-six miles a weeks. We calculate a horse a mile; that brings eight miles to eight horses, or fifty-six miles a week. Very few coaches will average more.

You think you should be able to compete with steam-carriages; do you think you should beat them?—I fancy so. I only hope that steam-carriages will be on the high road instead of being on raiiroads; there is every probability of our coaches doing very well if they draw about half the weight.—With a tramroad we could maintain about twelve miles an hour very easily; on a tramroad in narrow streets, where waggons or gigs are going, you will find the gig will over-run the horse.

Is there any difference in the tolls, on the roads with which you are acquainted, between steam-carriages and stage-coaches on any of the roads?—As far as the practical part of steam-carriages go, they do not have to encounter much with turnpikes; there are very few about London; the Metropolitan Act has done away with them.

There is great variation in your tolls, is there not?—Wonderful.

What are the highest tolls on the road you go?—The highest, taking the avorage per mile, will differ from 9s. to 17s. 6d. on different roads.

Per mile?—Yes; per mile per month; the difference will be on the whole of the month.

Where is the highest?—On the Birmingham line of road.

Are you connected with any coaches running between Glasgow?—We do not extend beyond Leeds or Manchester.

You run as far as Holyhead?—As far as Shrewsbury.

You pay a post-horse duty besides the tolls?—We pay a stage-coach duty.

Is it on the horses or the coach?—The coach.

Is there any duty on the steam-coach?—I am very sorry to say there is but little paid there; I think the competition is unequal.

What is the amount of duty on the coach?—It is according to the number of passengers we take out licence for; most are rated at two-pence halfpenny per single mile, which is five-pence per day; the number of passengers we are allowed to carry in each mile are four inside and eight out, in winter time; if four insides and eleven outsides in summer time, we pay six-pence. Steam vessels do not pay, nor do steam-carriages pay any thing to speak of. The steam-carriages do on the railroad pay a trifling duty to government, according to the numbers carried; if the machine is empty they do not pay; we pay, passengers or no passengers. We have a petition before the Treasury for reducing the price of freight between Dover and Calais and Boulogne, by the packets, as coaches going to Dover and Margate are obliged to pay a duty, which we cannot afford in consequence of the low price by steam, which does not pay duty.

You run the coaches?—It is difficult to reduce the number of coaches; the loading is extremely uncertain; we are obliged to keep the same number of coaches; we cannot reduce the number of coaches in consequence.

MR. GEORGE STEPHENSON, C. E.

Have you turned your attention at all to locomotive carriages on public roads?—Of course I have thought a great deal about them, having been concerned in them twenty years.

What is your opinion of them?—I think they will never be made to do any good on a common road; I do not see the slightest possibility of it.

From what cause?—The friction is so much greater on a common road than on a railroad, and we find we cannot with engines beat horses used on railways so very much at slow speed, as to economy. One reason why an engine competes at a much less advantage on a common road with horse power, than on a railway, may be thus stated? a horse consumes no more power in maintaining his own motion in drawing a load on a common road than on a railway; whereas from the great weight of an enigne, and the resistance being increased tenfold, the whole of its power is consumed in upholding its own motion.

The friction on a common road is, taking an average number, ten times what it is on a railway?—Yes; a horse will on a railway take ten times as much as on a oommon road. That being the case, the locomotive engine that is to go at this power, is travelling on a smooth surface on the railway, but the same engine using the common road is on a very different surface. The friction is increased so very much, that it has enough to do to propel its own weight, without any thing else; therefore the great advantage in getting the power generated is so much less on the railway than it is on the common road, that this alone makes a great differance.

You think, taking a given weight, say two tons, it would require ten times the power to propel it along a common road than on a railroad?—Yes, it would.

If you had to move two tons on a railway by a locomotive engine, what power should you find it necessary to apply to make it go at the speed of fourteen miles an hour; how many horse power?—It requires time to go into that. I will prepare that table. A horse will take ten tons, besides the weight of the carriages, at three miles an hour on a railway, and I think one ton at the same velocity on a common road. I could not tell off hand as to the exact proportions. It will require one horse power on a railway, and ten horse power on a common road.

You are well acquainted with the construction of these locomotive carriages?—I think I am; I think I have a right to say I am. I do not think there is a possibility of keeping the engine in order for any length of time from the jolting of the engine. I do not care what springs they put on.

Have you seen Mr. Hancock's carriage running?—No; I have been at Mr. Hancock's place, and saw his arrangements. I thought there was a great deal of ingenuity about it, but I told him in my opinion there was not the slightest probability of making them pay. There is no doubt of their making them go on a road, but not to make them pay, for I do not think any experienced engineer would be concerned in them. Many ingenious gentlemen have turned their attention to it, but if they had had much experience in keeping steam engines in order they would not have gone into it at all. The last engine made of Mr. Hancock's construction was made by Maudslay & Co., and they are most excellent engine builders; it must be well done if they did it. I do not care how well they are done; I do not see the slightest probability of their being made to answer.

Do you suppose that Mr. Hancock's engine, if it had been running twelve months would have been running at a loss?—Yes. If I saw his books I engage to say he must have been running at a loss.

You think there is not much danger to be feared if they can be run with advantage—if they prevailed?—As to daager that may be prevented.

There is no danger of their becoming common?—No; I do not think there is any probability; there will if full power is given to every one to use them.

If all the tolls that were laid on to stop them were taken off, you still think they would not run at an advantage?—I do.

You have said that there was a probability of obviating the dangers; state what you concieve the dangers to be?—Why, I think the most likely part of the machine to become dangerous is the boiler—the bursting of the boiler; they always endeaver to make them as light as they possibly can, and to carry as little weight as possible; they construct the boiler to carry very little water; and even if the boiler is made very strong, on account of the small quantity of water being carried, when the steam is generated that soon gets dry, if there is little water it must boil away, and there are accidents that will happen to cause them to stop. If the water gets boiled down to allow the pipes to become red-hot, hydrogen gas is generated, and explosion takes place. Explosions have taken place witht hese boilers; no satisfactory reason has been given how it occurred, but it has done so. I imagine that there must be a decomposition of the steam; that when the iron becomes red-hot. the oxygen of the steam will seize the iron, and of course the hydrogen is set at liberty, it is separated from the oxygen; then, if the plate is heated to a certain degree, it will take fire and explode. In the locomotive engines on the common railroad we carry as much water as will take us thirty miles.

On the railway?—Yes; my former observation is as to a common road; I am stating the difference between that and the railway. Our boilers are very large comparatively, and hold a great deal of water; the engine may stand an hour or two, and will not boil down the water; therefore there is not the same risk on a railway. More than that, we have a tank with a great deal of water to supply them in case it is wanted.

That you carry with you?—Yes. There was an explosion in Scotland from one of those, which was said to be by the breaking of a wheel. I do not see how that would make the boiler explode. I believe the boiler burst, and broke the wheel, and they merely made that excuse.

That was a large boiler?—One of the pipes, one of Gurney's construction; I think I saw it in Scotland; I saw it repairing; I understood it to be the same engine, but Mr. Russell took it up.

You saw an engine which was stated to be on Mr. Gurney's principle that had burst?—No, before this engine burst; I understood it was the same engine, if that which has been shown me was it.

Do you conceive a boiler can be constructed so small as to do the work required of it on a public road, and at the same time not to be dangerous if it bursts?—No; I think if the boiler is made very small it will not do sufficient work to work the engine forward at a desirable velocity.

Have you seen these boilers of Mr. Hancock's engine?—Yes, I have; they are merely a number of flat tubes.

The number of flat chambers is very small; if one were to burst would any evil arise?—No, I do not think there would be much evil from one of these chambers bursting; there is not that quantity of explosive matter to make the same injury; it might injure the individuals near it, but it would not do much damage.

You conceive, for security to the public, boilers must be limited in size?—Of course. I do not know that there will be any means of guarding against danger by testing the boiler, which would be perfectly safe if it was always certain that the water was always kept at acertain height, but if not there is no safety in testing; they might test before they went off, and before many miles the boiler gets too low, and the material becomes in a very different state? therefore testing ceases then to be of use.

That testing does not meet the objection you mentioned before of the hydrogen gas being generated?—Certainly not.

The only security to the public would be, that the chambers should be so small that if

it did burst no injury would arise?—Certainly; each of them should be so small that it would not do much injury if it did burst.

What should be the limit of the size of these chambers?—I could not go into that without consideration.

You know the nature of Mr. Hancock's mechanism?—Yes.

Do you think there is any danger attending it?—I think there is not much danger.

Do you know Mr. Gurney's patent?—Yes.

Do you think there is danger attending that?—There is not so much danger in the tubes if they are kept small, but then you cannot generate sufficient steam.

You think there is no danger?—Yes; I think there is more danger in Mr. Gurney's than in others, for there is a greater quantity of steam held in the pipes than what is held in the chambers of Mr. Hancock's.

What is the danger, explosion?—Yes.

Do you think pipes of that size, if they exploded, would injure the passengers?—If there is a long continuation of pipes connected with it, I think that will so far hold good in Mr. Hancock's; if they are so connected that the connexion will give a free outlet from the other chambers, it is still objectionable.

Are they so?—No; there must be a connexion to get the steam generated; I do not know the size of the apertures. I know if one or more tubes gives way in locomotive engines of an inch and a half or two inches in diameter, it does not do much injury; they stop the two ends up, and go on again. I do not think they can do that with Mr. Gurney's or Mr. Hancock's.

Have you ever travelled by Mr. Hancock's or any one of the steam carriages?—No; I saw one down here, and I stopped to see it go off.

Did it make much noise?—No, I think it did not.

As much as one of your locomotive engines?—No; ours gets the steam off into the chimney; by that we get power to send us along; if they get power in the same way they would go faster on the roads. It is that set that occasions a noise like the barking of a dog. They do make use of something in the road engines, but it is muzzled, so that the noise does not escape; they must always make use of the outlet through the cylinder to force the current of atmospheric air through the fire, but they muzzle it so that the noise is not heard. Our engines are from twenty-five to thirty horse-power, and those on the roads are not more than three or four horse-power. I am not quite aware, though the power may be great to begin with, it may be soon got rid of so as not to be power at all. It is not fair to calculate power by the size of cylinders. The question is, can they keep it up; if they could keep it up at the rate it set off, it would be a fair calculation to measure from the cylinder; whereas they frequently stop to allow the steam to increase the strength, then the boiler is not sufficient to supply the steam.

Do you understand that to be the case?—Yes; that one that came to Liverpool was a long time on the road, but it stopped very often.

And was assisted sometimes?—Yes.

What is the size of the chambers you make use of on the Manchester and Liverpool railway?—They vary from one inch to an inch and a half, and others have two inches.

In diameter?—Yes.

Not larger than that?—No; the first we put up was three inches; that was the Rockte, the first swift engine; we found that we could make more steam by diminishing the diameter, and getting more (and we got more) surface, and we had them of less diameter since.

Was there much smoke from these engines?—No, I did not see much.

As much or less than the engines on the Liverpool and Manchester?—It must be the same, for they both burn coke; if they burn coke they must have the same proportions.

You do not think there is any means of diminishing the smoke?—I know of nothing better than coke; there are still fumes; a quantity of sulphur comes off.

That offends the nose, not the eye?—It has an effect on the eye also.

It surely makes a very considerable degree of smoke?—If well coked there is no smoke.

But on the Manchester and Liverpool?—Some parts of the coke is not well coked; but if it is properly done there can be no smoke from it, but fumes; there is a decomposition of the air passing through; what comes out must be different from what goos in.

Is it visible to the eye?—No; even the steam is not visible at a temperature of eighty or ninety degrees.

That is on a very hot day?—Yes.

You have turned your attention a good deal with locomotives-engines, to prevent the flying off of sparks from the ash-pit?—Yes, I have tried that, but have not succedeed in it yet.

You could not say if Mr. Hancock's is less?—If his blast is less it will not make so many sparks. I think the ash-pit may be managed; I think that may be so boxed in; it will be injurious to the making of steam, but still it will affect the engine. The freer the air gets to the fire, the more steam will be made at a less expense.

You have not done it on the Liverpool and Manchester Railroad?—They have had boxes, but they are obliged to open at one end, and when the cinders drop out they fly out of the box, and then if they come in contact with the wheels, the wheels moving at such great velocity sometimes throw it a considerable distance.

The sides of the railroad are frequently burnt?—Yes.

You have had one or two serious accidents with fire?—That is since I left the Liverpool and Manchester.

You had one in the north, on a railroad you were concerned with, had you not?—There was a little farmhouse and building set fire to and burnt down.

Are you aware of the particular circumstances of the case?—I am perfectly sure of that being the case.

Do you know at what time the engine passed, and what speed the engine was going?—No, I do not know.

The danger of course is great with a thing of that kind in proportion to the speed at which the engine is going?—More sparks get out at a higher velocity than at a lower velocity; the draught is increased as the velocity is increased; but it is not increased by passing through the air, but by the greater quantity of steam being jetted into the chimney, which forms a vacuum. In the chimney a pipe stands up like the jet-pipe of an extinguishing engine, and all the steam that is required to supply the power of the engine has to pass out of that jet-pipe. It moves at such a velocity, it drives all the atmospheric air out, and leaves a vacuum below. There is no opening to fill up the vacuum, only through the fire, and of course we get the weight of the atmospheric to pass through the fire. In looking through the hole in the door I have seen the fire as if it was dancing on the bars, the current so strong as almsst to lift the cinders, and many of them were brought out through the pipe and up the chimney.

Is there more effect of that kind in windy weather than on a still calm day?—Of course, if the wind is blowing laterally to the train of the carriages it will.

Does it make the draught more rapid?—No, it has no effect on the draught.

You have not tried to make gauze or wire covers at the top of the chimney?—Covers we have; and we have tried various sizes, so as to keep the sparks in and let the vapor out; but it has been all useless. I have tried it at various sizes till I have been obliged to take it off, the engine was so diminished in power; it was injurious to keep it on.

You saw Mr. Hancock's engine; had he any precautions of that kind?—That I do not know; I have not seen that part of his engine.

What is the usual weight you carry in one of your trains; your passenger train?—Forty or fifty tons; no, not more than thirty to forty tons, carriages and passengers together. We have engines now made that if they were travelling on a level road we could take 400 tons; they will take a large ship-load of goods at once, at fifteen miles an hour; we can make them take 400 tons on a level. I would engage to make one of 100 horse-power to move on a railway; we have made them at 50 horse-power, and have sent some of the same power to Belgium, and, I think, some to America.

You think that you are not yet arrived at that point that you can do any good with a locomotive-engine, effectually guarding against any sparks dropping out or flying out from the chimney?—No we have not, certainly; from all I have done and seen it has not yet got to that state.

You were understood to say according to the velocity you go those sparks were carried to a considerable distance if they met with the wheel?—That is from the ash-pit; the sparks from the chimney are guided by the wind; if the wind is blowing longitudinally with the road the sparks do not leave the line of railway so much, but if the wind blows at right angles the sparks are carried to a considerable distance. The sparks from the chimney of a locomotive-engine are not like the sparks from a common chimney that is on fire. You frequently see a chimney on fire, and sparks come out; these have not the same tendency to ignite; they are so light that when they fall to the ground they are almost extinguished, and combustion

ceases. But those that come out of a locomotive chimney have more weight in them, —they are cinders, and there is a quantity of heat remaining in them.

If there were a cap in the form of an umbrella, and they were thrown back into the chimney across, would bad consequences arise from that?—It would diminish the power of the engine; that has been tried; it was one of the schemes resorted to on the Liverpool Railroad by putting a kind of umbrella so that the sparks should be thrown downwards; and it diminished the power of the engine.

Suppose you had a lateral outside chimney, made of very fine wire, so as to carry the sparks down that, and let them fall on the ground?—I think such a covering might be made, only it would be very large and cumbersome, yet it might be made so as to prevent sparks getting out, except of very small dimensions; but it must be very large and expensive to keep up, and it would be destroyed; the free outlet of the chimney would be obstructed, and the power of the engine so much diminished, it could not travel with velocity. The sole power of the engine depends on the exhaustion of the steam into the chimney; if it was only the height of chimney, the draught, without the blast-pipe, would be so much diminished as to reduce a 50-horse power engine to not more than 2 or 3-horse power.

With regard to the power of stopping the engine on the road, in what space do you conceive you could stop an engine going at full speed on a common road at fourteen miles an hour?—I should think from fifty to 100 yards; it depends on the weight and the momentum. The only means made use of in stopping them suddenly is preventing the wheel revolving by the application of the break, and reversing the power of the engine, so that the wheel becomes a sledge, and brings the revolving motion into a sledge motion. It is this sledge motion that takes up the momentum. It requries some calculation to know how soon. The weight of the engine must be given, and the velocity and the friction taken, to state at what distance it can be taken up; it depends also on the state of the road. If it is very wet weather it will not be taken up in the same time as if it were dry. When it is icy the sliding motion would allow the carriages to move forward with as little friction as the revolving motion, which is well known in those countries where dogs are used for drawing sledges through the snow, so that it amounts to a railway; in such cases a sliding wheel would not stop them so soon.

Do you think a weight of three tons could be stopped as easily as a four-horse coach, and in as short a space of time?—I do not think a four-horse coach could be stopped at much less than fifty yards, going at fourteen miles an hour. I think the engine would be as powerful in stopping the carriage as the horses, but I cannot conceive a four-horse coach travelling fifteen miles an hour would stop in much less distance than fifty yards. I think the horses would have a little advantage in throwing their weight against the momentum of the carriage.

How soon could you bring up an engine, travelling ten or eleven miles an hour, on a common road in summer-time?—I should think about forty yards, going at ten miles an hour. I judge from what I have seen frequently done, when a coach is called to stop it does not stop immediately.

You find great difficulty on the railroad in turning, do you not, in taking a short turn?—We do.

That is one of the points in which the system is chiefly deficient?—Yes, the power is very much diminished indeed if the curve amouts to above a certain ratio; a mile radius is the standing point we have got to; we endeavor to keep as near to that as we can. The wheels of the carriage are made conical, so that when we do come to a curve, the larger part of the wheel goes to the exterior rail, and makes up for the extra distance, so that in some degree we manage it in that way; still there is the momentum to be retarded in its progress. All matter put into certain velocity requires a certain power to change its position.

You have on the railroads things that turn to chenge the direction of the engine?—We have; but that engine must be in a standing position.

You never venture to turn an engine except in that way?—No.

Do yon conceive that in these steam-carriages it would be possible to turn round the corner without stopping the engine?—Yes, they certainly can turn better than we can do, they have a swivel motion in the under part of the frame that they can turn it like a gentleman's carriage. It would be dangerous to have railway engines so constructed. In our engines if the wheels are left to get out of square, that is, if an obstacle is on one rail when moving at a great velocity, if the wheels are left to swing round as the wheels of gentlemen's carriages, the wheel that struck the obstacle would be retarded in its progress, and the engine would turn round and go off the road.

The difficulty depends on having the rail to run on; but it would not exist on the common road?–No; they can be made to turn on a common road something like a gentleman's carriage; but that cannot be made use of on a railroad at high velocities, from the circumstances I have stated; that is, from the construction of the engines. Neither can loose wheels be made use of; the wheels in our engines are always made to revolve with the axle-tree, so that when the wheels are made to work in a square frame they cannot change their position. If an obstacle happens to be on the road, and one of these wheels comes in contact with it, the other wheel assists in getting over it, for they all are confined in the direction of the rails. There is a contrivance I saw the other day for passing round curves, but it is by having a centre to move on, so as to change the direction of the wheels to suit the curve like a gentleman's carriage. I thought it would not do.

That would not be safe?—No; nor could machinery be attached so properly to it; we frequently, with powerful engines, connect all the four wheels together; you cannot do that if they move on a centre.

The result of your evidence seems to be that you think testing no use?—I do not think it is; it might be of some use; but it would not be so useful as to prevent danger from what I have stated.

And you are of opinion that there would be danger of a boiler bursting if the chamber were above a certain size?—If they are connected together; it depends on their connexion. Our pipes are not connected together; therefore it is only that one aperture which gives way, and allows the steam to escape.

In your engines you use a pipe of what diameter?–Varying from an inch to two inches diameter.

Should you think a pipe of any larger diameter dangerous?—As it increases in diameter the danger must increase with it.

Whereabout does the danger commence?—I think at three inches diameter; I think if it gets above that it will become dangerous; dangerous at three, but still more as it increases in diameter.

You do not think any mode has been yet devised that will prevent the escape of sparks from the chimney?—I think not, not without diminishing the power of the engine.

In engines of large power?—Of course engines with smaller power will have chambers of smaller dimensions, and the same covering put in small engines will affect it in proportion as it will in the large one.

Is there any mode devised at present of entirely preventing the fall of ashes into the ash-pit?—Nothing more than what I have stated.

Without injury to the power of the engine?—I think not; not that I am aware of.

MR. ALEXANDER GORDON, C. E.

Thinks that he is quite an impartial person as regards the merits of the different carriages. Believes that several steam-carriage inventors say that he is partial, but as almost the whole of them say that, considers it as a proof that he is not.

Have you travelled by all those carriages that have been going?—I have travelled by Gurney's, by Macerone's, Hancock's, Field's, Ogle's, and Russell's, and others.

What speed do you think those steam-carriages can travel upon the road?—I have travelled at a speed varying from two miles to fourteen, fifteen, and sixteen, and I have gone a mile at the rate of twenty.

The average rate, taking a good road without any peculiar feature belonging to it, would be how much?—Varying from ten to fourteen would be the rates at which they could travel with most profit.

And without danger to the public?—Yes; they are perfectly under command.

In what possible space can you stop one of those carriages?—Certainly in a less space than a two horse coach.

What do you conceive is the greatest capacity which is consistent with safety?—I should not like to give a hasty opinion upon that. It is a difficult subject to touch upon. I should prefer not to use a chamber larger than that now before your Lordships, and used by Mr. Hancock; nor if I were to use one of Mr. Gurney's should I use one larger than that he has at present; nor would I travel with such a carriage as Russell's boiler, which was attended with the accident near Glasgow; it had a large chamber.

You cannot state what should, in your opinion be the extreme size of the chamber of a boiler?—If the chamber of the boiler be cylindrical, I think eight inches or ten inches at most; but I understood the question to refer to a clause in the bill now before your Lordships. In that bill there is a prohibition, I understand, of certain rectangular figures.

What is the proper shape for the chambers or compartments of boilers for these carriages, and of what size may they be made consistently with the safety of the public?—To transmit heat from the fire to the water in the boiler, so as to generate steam of the requisite intensity, a certain surface of the boiler, on which the fire and heated gases play, is necessary; this surface must bear some proportion to the quantity of water to be evaporated. The requisite quantity of surface was in the early steam-engines obtained on the outside of the lower portion of the boiler, which therefore required to be of large size; subsequently the boiler was diminished, and the requisite quantity of surface preserved by directing the flue through the water in a large pipe. Steam-boat boilers required to have still more of these flues from the furnace to the chimney, so that these boilers might expose the smallest weight of water to the largest heating surface. Railroad engines required a still greater proportional reduction of water to obtain lightness, and a still greater proportional heating surface; this was obtained by multiplying the number of flues through the water from the fire-place to the chimney; the flues were reduced in their size, and more of them (sometimes 150 small tubes) were caused to pass, carrying the heated gases and flame through one large chamber in which the water is contained. Such is the general description of railway boilers now in use: they have each one large water and steam-chamber surrounding the fire-place and flues; they are erroneously called by some, tubular boilers, whereas they are large chambered boilers with tubular flues. The material difference between the boiler just named and the small chambered boilers of Gurney, of Dance and Field, of Hancock, and of Maceroni, and of a few others, is that the fire-place and flues in these latter form the large chamber, and the water in small chambers, in films or streams, is presented to the heat in the large oven or furnace. These numerous small chambers of water and steam are safer than the large chamber of water and steam, because the fracture of one of the small chambers does not involve the danger of an explosion of the whole. The ingenuity of the inventors is seen in the arrangements of the tubes or chambers, so as to allow the contained water to receive its heat from the fire, and to part with its steam unmixed with liquid (i. e. dry steam) to the engines. Hancock's boiler may be considered a number of small rectangular boilers, ranged beside each other,—as books in a library,—and connected together, in each of which circulation and separation are required to go on: Gurney's boiler is a number of small tubes in the fire; water sweeps along them, becomes heated, and rising into a chamber or chambers out of the fire the steam is separated from the water, and ready for the engines, whilst the water (with or without an addition to replace evaporation) returns by another channel to sweep again through the small heated pipes. The boiler of Sir Charles Dance and Mr. Field is very similar to that of Mr. Gurney. Of the boilers which have been used on turnpike roads some are circular in the cross section of their parts, others are nearly rectangular in the cross section. The circular is known to be, according to both theory and practice, stronger than any other figure. Were it necessary I could give your Lordships numerous instances which occurred to me during many years' practice, with some thousands of my father's portable gass reservoirs, at a pressure of 450 lbs. on each square inch. The repellant and fluent particles of steam force outwards in radical lines, and their force is best resisted by hooping them in, all round; the forces are then equal, and they are resisted by the absolute strength of the metal or the resisting force of cohesion. If, however, we confine steam in a square box, or other straight-sided figure, we expose the metal on the straight side of the box to another kind of strain,—the greatest strain to which metal can be exposed,—the power of the steam tending to break the metal transversely; the box is forced by the internal pressure to alter its shape, and bulges out; the metal is crippled, and fracture takes place, generally near the angle, the portions of metal on the same plane performing in some degree the functions of levers. Of the two shapes there can be no doubt the circular is incomparably the stronger.—With regard to the size of chambers of such boilers as are to be allowed on the turnpike road, I think that until some means of preventing explosion, not yet known, are introduced, no cylinder of greater diameter than eight inches should be allowed in such boiler or steam-generator for the turnpike road, and no rectangular or other shaped figure of such boiler or generator shall be of more than forty-nine square inches of transverse sectional area, and no vessel or compartment of such boiler should be made in part or wholly of cast-iron. I have in this answer specified the area of the rectangular figure, which is equal to the area of the circle, eight inches diameter, not because the rectangular figure in any measure equals the circle in strength, but because if an explosion does take place the same amount of steam and water may be presumed to escape. I believe, however, the area of the fracture would in case of accident always be the largest in the rectangular figure.

Inform the committee of the weights of stage coaches, vans, waggons, and steam coaches, with the view to levying a toll on the latter; and also of the probability of steam conveyance being more general on the turnpike road or on the railroad?—Of these conveyances the most destructive to the road are the light stage coach and mail coach. In them there is a greater proportional weight resting on a square inch of the tire than there is in any of the other conveyances above stated. The difference in the rates of travelling is of less consequence; of the proportional damage done to the road surface by horses feet at a quick or at a low rate, I do not know that any experiments have been made; and in my opinion the damage done by a steam-carriage and load to the road is certainly not one-third part of the damage done to the road by the mail or stage-coach and its horses, the weights moved being in both cases the same, and, after long and careful examination and experiment, I should say, that were I the proprietor of a road I should prefer the steam-carriage, even of six tons weight, as the least destructive; and having special regard to the interests of the road-trusts of the country I say the same.

	Rate in Miles per hour.	Average Weight in Tons, Coach and Load. without Horses.	Observations.
Mail or stage-coach	8 to 11	2½	Average weight of each Horse in any of these Conveyances may be stated as Ten Hundred Weight.
Van	6½	4½	
Six-horse waggon	3 to 3½	4½	
Eight-horse waggon	3 to 3½	6 to 7	
Steam-carriages	7 to 14	2 Tons.—Some are much heavier. I have seen one Six Tons weight. The best amongst many that I have seen and travelled by was not Three Tons.	

MR. THOMAS HARRIS.

Was the engineer who superintended Mr. Gurney's steam-carriage while running for Sir Charles Dance between Gloucester and Cheltenham.

While you were running between Gloucester and Cheltenham, do you imagine that was a profitable speculation to Mr. Gurney?—I do not know; there was a great expense in establishing coach-houses and buildings, and the time was not long enough, I should think, to refund. I think we could have done very well.

Do you think the traffic on the road paid the expense of carrying it on?—Yes; it cleared it well.

Would it pay the expense of carrying it on in London?—I have not a doubt it would.

Then it is not from the extent of tolls you were prevented from doing it near London?—I believe not.

Do you know for what reason Mr. Gurney did not continue?—It was a matter of choice on the part of Sir Charles Dance.

REV. MR. WILLIAMS.

You can give evidence as to steam-carriages?—Yes; I have rode on them more than any person in England. I am a great advocate for them.

You are an amateur traveller in them?—Yes; and I understand something of the

mechanism as well. I know something of the construction of all that were built in London.

Have you ever travelled by Gurney's carriage?—Yes.

Do you know the nature of his machine?—Yes, it is a tubular boiler.

Can it be used on roads with safety to the passengers?—The fact is, his boiler is safe, perfectly safe, but he has got an appendage to this boiler which is called a separator, or, as I call it, a danger-chamber, in order to separate the water from the steam. Within the tubes the steam forms, as it were, a corkscrew or coil, and brings out the water with the steam before it passes to the cylinder where the piston is. In order that the steam should be efficacious he has got the separators, and these are of large capacity; the consequence is, it does not signify whether the boiler is tubular, spherical, or of any other construction. If you bottle up that steam, they are all dangerous, which is the case with Gurney's; it is a dangerous boiler as long as there is a place of capacity for the steam, for if that steam is not passed off to the piston that works in the cylinder up and down, or horizontally, if you do not pass it off immediately it will burst any thing, whether it is a sphere or whatever other shape.

That separator is peculiar to Gurney's?—Yes, I think so.

You think that it is productive of danger?—Yes.

Have you been by Gurney's carriage?—Yes; several miles.

Have you met with any accidents?—No.

You trusted your life in it, notwithstanding your knowledge of the danger?—Yes; knowing that the engineer, Mr. Stone, made his valve only to a safe pressure; but suppose you come to a depth of gravel on the Cheltenham-road, eight or nine inches thick; the depth of the gravel was rather more than is usually laid by trustees on roads; it was not enough to impede a mail-coach, but it impeded his carriage, and the consequence was that they used a very great pressure there to get over, but with it the axletree broke.

Were you in the carriage at the time?—No.

You were not one of those who were blown up?—No.

Therefore danger did not occur?—No.

Have you known a case where it did occur from the boiler bursting?—Yes, at Glasgow; it was Gurney's carriage, sold to a person of the name of Ward; their carriage was in a coal-wharf at Glasgow; the person who had the management of it put on the steam, and was going to show it off to great advantage; the steam was so powerful, that either the separator or the boiler burst, and a boy or man was much injured.

Was there a separator?—Yes.

Did you see that?—Yes.

Was not that a carriage with a large chamber?—Not much larger than the usual chamber.

Was it not with a large square chamber hung under the carriage?—No; I think a cylindrical one.

But the one that burst?—Yes; I have rode on them likewise; the Scotch carriages; I have rode on it 300 miles.

But keep to Mr. Gurney's carriage; was that it? (*Pointing to a drawing.*)—No, that is Russel's; here is the boiler, which is of large capacity, and would not bear a pressure of above 35 to the square inch. I rode in this from Hammersmith to London scores and scores of times, knowing they never worked at a pressure of 20 or 25, therefore it is safe, though it is a boiler of large capacity; the safety depends on the engineers; they may blow up any of them if they load the valves to more than they can bear; but it can be prevented by a lock-up valve.

You think all steam is dangerous?—Yes; it depends on the engineer employed if he has the sole control of the valves.

You venture on board steam-packets?—Frequently; and I consider them more dangerous than steam-carriages, having boilers of great capacity, containing thousands of gallons.

Then you are an enemy to steam in general?—No; it depends on the engineer entirely; if he is fool-hardy enough to use higher pressure than a boiler can bear, no carriage is safe.

Did you ever travel by Mr. Horne's stage-coach?—Yes.

There your safety depends on the coachman?—Yes, and on the management of the horses entirely, and the coach-builder; if the axletree breaks, or a spoke or spokes break, you must come down, and most likely dislocate a limb, or lose your life. I should rather a steam-coach for travelling on, if one safety-valve is locked up from the engineer, than the best-conducted horse-coach that I know of. I do not consider boilers without the steam-chamber at all dangerous; but if they have got such steam-reservoirs, they are dangerous.

Go back to this carriage of Mr. Gurney's that burst at Glasgow; when was that?—I cannot recollect dates.

Who was the proprietor of it?—A person of the name of Ward, a man who lost a great deal of money speculating in Gurney projects, like many other gentlemen that advanced money in his concerns, to the amount, I have been told, of 40,000*l*.—This is Russel's carriage (*producing a drawing*); an advocate in Edinburgh, a Mr. Dauney, a friend of mine, lost 10,000*l*. by embarking in it.

Do you know Mr. Hancock's carriage?—Yes; I have rode in them upwards of 4,000 miles; the reason why I did so was, he was continually working on all roads, winter and summer; the prohibitory tolls had nothing to do with his carriages; *he could go distances on roads where the Acts had not been renewed, the same as Mr. Gurney might have done if he had been in a situation to run.* In the metropolitan districts the Acts were renewed, and applied to steam or any other power; but the expenses attached to that are not prohibitory; it is 4*d*. on his carriage instead of 2*d*., being double tolls in proportion to omnibuses.

Do you think the tolls were prohibitory in the other places?—Yes; but Mr. Hancock did run thrice from London to Brighton, and paid no tolls at all.

Do you think his carriage is dangerous?—No; he has no steam-chambers. An accident happened in his factory; a part proprietor in one of his carriages tied down the safety-valve with a coil of wire, so that it was impossible any thing could bear the pressure; a rend seven inches long took place; he was not hurt, but paralysed from fright, the surgeon said. There has been no serious accident from any steam-carriage of Mr. Hancock that I am aware of.

Not any whatever?—No, not on the roads, never an accident while going.

Did you ever hear of the Birmingham carriage?—Yes, but on turnpike-roads. I rode in that carriage, (*pointing to Squire's and Maceroni's,*) which is a very excellent carriage; I have rode from London to Uxbridge and back, to London twice, and also in Ogle's several times.

The result of your opinion seems to be, that they are all dangerous, but that no accident happens?—If the engineer is a fool-hardy fellow, it is dangerous. I have rode 200 miles in one, and I have rode in Mr. Ogle's carriage 100 miles; now his carriage is as fast as any of the carriages, and as safe; I do not think he has a steam-chamber; the boiler in his carriage is composed of a tube within a tube, and caloric impinges on the water inside and out; he generates steam as fast as the engines require it, which is the case with Mr. Hancock's, I do not think any of them are dangerous, provided the engineer is not intrusted with the key of one of the safety-valves.

MR. WILLIAM CUBITT, C. E.

You were one of the party of engineers who subscribed towards the building of a locomotive carriage by Messrs. Maudslay and Field?—I was. It originated in a sort of challenge which I gave the parties to prove the possibility of doing the thing.

What was the result of the acceptance of that challenge?—The result of it was that a carriage was built, and remarkably well built; it travelled exceedingly well, and was very manageable; *it proved that the thing was perfectly practicable*, but was not economical or expedient to be applied to the purposes of traffic.

Can you state to what extent it was not economical?—It was not economical in this respect, inasmuch as the expense of the machine and the expense of keeping it in order was too great to be put in competition with railway travelling or even with common roads. Such, at any rate, was the result, in my judgment, from the experiments we were enabled to make.

In what respect did the inexpediency of it consist; was it in travelling?—It was on account of the great cost of it.

Did you not draw a distinction between the two; expediency and economy?—I intended to say it was not expedient because it was not economical.

Has it no other disadvantage?—No; the thing is perfectly practicable; there is no difficulty whatever in making a good carriage which will travel remarkably well.

We have gone up steep hills with the one we had in Dulwich and the neighborhood, but the great cost is against it.

Is it not dangerous to the passengers?—Not under proper management any more than any other machine.

Do you mean than any other coach?—Yes.

Is it not dangerous to the people on the road by frightening the horses?—Not at all; I have been frequently through crowded roads in the neighborhood of London and I have never seen the horses frightened.

What was the weight of it?—Between five and six tons.

Was that as light as could be made?—It might have been made a little lighter.

Did it do much damage to the roads?—Not the least. I think if it were made properperly it would rather mend the roads than otherwise, inasmuch as the wheels must be broad wheels, and cylindrical, and therefore they roll the roads.

Have you ever seen Mr. Gurney's steam-carriage?—Never.

You do not know any thing about the contrivance of that?—No. The contrivances are all on one principle; the great object is to contrive a boiler which will combine lightness and a capability of giving a great quantity of steam.

In your opinion they are not so economical as stage-coaches?—They are not so generally useful or economical as stage-coaches, because there must be an immense establishment to set them going; to run from here to Bath would require a great many locomotive carriages, and a vast establishment of workshops and stations? in fact under such management as railway carriages, which would be attended with much more expense.

What was the cost of yours?—One thousand guineas, by agreement.

What was the size of the boiler?—Our boiler was a boiler of peculiar construction; it was an assemblage of tubes, and I believe it was on the principle of what is called Gurney's boiler; at least I think so.

Who directed the form of the engine?—Mr. Field himself, subject to the approval of myself and one or two other engineers.

And you all came to the conclusion you have stated: it was an unanimons opinion was it?—I do not know that it was unanimous; we never met to express an opinion upon the subject, nor do I know what the opinion's of the other parties are; I do not even know what Mr. Field's opinion is, whose judgment I should most rely upon. I made six or seven journeys, and the result of my experience was that it was practicable but not expedient, beeause it was not economical.

From the experiments you have made are you satisfied that more economy could not be introduced in the management of steam-carriages,—that they conld not be conducted sufficiently economically; have you made sufficient experiments to satisfy yourself upon that point?—I can only speak from the experience I have had; I doubt they could be conducted economically except upon such an immense scale as it would be impossible to establish; for instance, it would be impossible to establish a steam-carriage—to have one or two steam-carriages running from London to Bath, it would cost more than it would be worth, and they could not take passengers in competition with well-managed coaching; they could not do that but by the investment of immense capital, having an immense establishment, and doing every thing upon a very great scale. It would be necessary perhaps to have a hundred steam-carriages to keep a concern continually going.

Is not the formation of a large capital perfectly possible?—It is.

Are not railways conducted by companies?—Yes, they aro; but there is not the difficulty attending the construction of a railway and the managemenr of carriages on railroads that there is with steam-coaches; we require a totally different class of persons. In a railway a man of comparatively common talent will do for what they call the engineer, that is to manage a locomotive engine; but in managing a steam-coach it is quite different, there is the greatest presence of mind required, he should be a person of great sharpness and firmness to manage a steam-carriage on a common road; we were fortunate in having a very able man at the time we made the experiment; he was a man of the greatest nerve and spirit, and he was also a person of great mechanical skill; it made us all nervous sometimes to see him steer through a string of carriages in the way he did.

Have you ever made any calculation as to the difference of speed between what could be accomplished on a common road and what could be accomplished on a railroad?—No; but I should say I scarcely know a limit to the speed that could be obtained upon a level and good railway; I should say there is no limit till the power is balanced by the atmosphere, which would be upwards of sixty miles an hour certainly.

MR. JOHN BRAITHWAITE, C. E.

Have you directed your attention to the distinction between locomotive-engines and carriages that run on the highway?—I have; not that I consider much difference between them.

Are you acquainted with the construction of any of those carriages?—My attention has been called to them, but not with regard to any particular plan; Mr. Hancock's and others, Mr. Gurney's and Colonel Macerone's all of them have been experimentalizing for a considerable time, but it does not appear that the result has been what we should call practically successful.

As an engineer well acquainted with these things, do you imagine that the science is sufficiently advanced to enable you to build such an engine as would be both safe and sufficiently economical for general purposes?—Certainly not.

Do you think there is any danger in them?—I do not think there is any danger.

Then the objection is decidedly upon the ground of the expense being greater than the profit would justify?—I should say so most decidedly.

For what railways do you construct locomotive-engines?—At this present moment we are constructing a great many for Cuba, and we have also been applied to by the Birmingham and London Railway Company. The great difficulty is to get parties who will construct them with sufficient care and attention. Some time since I was competing with Mr. Stephenson upon the Liverpool and Manchester Railway with an engine, which was called the Novelty. It was then given as the opinion of many persons that if locomotive-engines cost as much as I asked of the Liverpool and Manchester Directors, namely, 1000*l.*, that that of itself would be a decided prohibition to the introduction of steam-carriages on railways; and yet, notwithstanding that, we are now receiving not only 1000*l.*, but in many instances 1200*l.*, 1300*l.*, 1400*l.*, and 1500*l.*, for locomotive-engines.

How is it that their price is not a prohibition?—From the circumstance of the great duty which the engines now do, which was never anticipated. At one time it was thought we never should do more than something like twelve miles an hour; but the result was, that we did at the rate of forty-five miles an hour.

Do any of your engines run upon that road?—No; I do not choose to build engines after a model which I know to be objectionable, unless desired as a manufacturer; and as they saddle us with the responsibility of proving these engines, which would necessarily take me a distance of 200 miles from my place of abode, it is rather too far to undertake the management of them.

Have you any carriages running on any existing railway?—Not at present; we are making several; but of course, having a very extensive manufactory, we are obliged to make for the market. We are making them upon the model laid down by the Liverpool and Manchester Railway Company,—Mr. Stephenson's improved by Mr. Berry.

Have you turned your attention to the means of preventing sparks from flying out?—Yes, I have.

Have you, in your opinion, succeeded in effectually preventing it?—No, I have not.

Have you succeeded in effectually preventing any loss of cinders from the ash-pit?—Yes; we have a tray constructed at the bottom part of the grating to receive any thing that falls.

Do they not fall out?—Occasionally they may do so, when they have been stoking very furiously for the purpose of effecting particular objects, such as getting up the inclines; then they require abundance of steam, and stoke furiously; and now and then cinders fall out in spite of the greatest care.

From the Mechanic's Magazine.

INTRODUCTORY LECTURE,

The basis of all physical knowledge has been stated to lie in experiment, and the careful observation of facts. The truths thus obtained, so long as they are considered individually, are of value to direct our practice, only when the circumstances under which they were originally noted, recur without variation. It is not only necessary to record them, therefore, but to classify hem; in order that phenomena, which are

probably connected, either in their supposed cause, or in their appearances, may be considered together. Up to this time we use no scientific process, the record and classification of the facts, is purely historical, and has been said to constitute a department of that division of human knowledge, under the name of Natural History. This name, it may be incidentally stated, is now usually given to the description of the external characters of the bodies which we rank by their obvious qualities in the three great kingdoms of nature, the Mineral, the Vegetable, and the Animal. This department of knowledge has, however, been elevated, by the introduction of Philosophic reasoning, to the rank of a science, and we should, in speaking of it, give it its true value, by including its several branches under the denomination of "The Natural," as distinguished from the Physical Sciences.—When certain facts, obtained by observation or experiment have been classified, we are generally able to find among the phenomena which they present, one or more which are applicable to them all. A general proposition expressive of this agreement may then be deduced and applied to them without exception. Several such general propositions may be found to agree in some one or more points, and this agreement may be, therefore, expressed in a proposition of still more extensive application. Proceeding in this manner, from individual instances to general, and from general propositions to those still more general, we may finally, sometimes, reach propositions which include in their expression all substances on which experiment can be made, or which observation can reach. Such a proposition, unlimited in its application, is called a law of nature.

At other times we find the proposition to be limited in its application, to one or more classes or orders of natural bodies.

We are said, in thus obtaining general propositions from individual facts, to employ the process of induction.

It is, however, impossible to collect every individual instance, and thus obtain complete proof of the general laws by induction alone. But we are warranted in concluding the truth of the proposition to be absolute, if we find it to apply to every case in which it is possible to make experiment or perform observation. We are now said to reason from analogy.

As an instance of the inductive process; of reasoning by analogy; and of the limit of some inductive propositions: I shall cite a very familiar case, drawn from Natural History, and partly connected with our most early impressions.

A child observes, that in his parents and play-fellows, the sensation of vision is operated by two concurring organs, and is not slow to become aware that he himself is similarly constituted. He finds the same provision existing in all the individuals of his race which he meets. He therefore infers, partly by induction, and partly by analogy, that "All men have two eyes." This is the first step in generalization, for until he had reached it, it would have been necessary for him to name the individuals in whom he observed the common fact.—He will probably have ascertained the truth of the same proposition, in respect to a variety of species of animals, but he cannot make the second step in generalization, until he have studied the elements of Natural History. He will then find that man, and all the animals in whom he has observed this peculiarity, belong to a grand division of the animal kingdom, which naturalists call the vertebrated, and will by two successive steps in the analysis—steps, we need not repeat here,—reach the most general proposition of all, namely: "*All vertebrated animals have two eyes.*" He cannot proceed farther, for he will find in other grand divisions of the animal kingdom, provisions totally distinct, or the faculty and organ wholly wanting; for, some animated beings have eyes innumerable, and others none. In reaching this most general proposition, he must have proceeded partly by analogy, and he can now apply the analogy to obtain even more extensive knowledge; for if he find, buried thousands of feet beneath the present surface of the earth, a fossil bone, although belonging to one of a family which has long since become extinct, he infers at once, that it, when living, had the same provision for receiving the impressions of light as existing vertebrated animals.

When a general proposition has once been obtained from individual instances by induction, we may, therefore, by analogy, make use of it to explain new facts, or to predict natural occurrences; we may also apply mathematical reasoning and calculation, and in either way may obtain propositions as certainly true as the result of the original induction itself.

We are now said to make use of theory; and although the term theoretic has been opposed to practical, as an epithet almost of reproach; it would were the individual to whom it is applied, worthy of it, be the highest possible praise; for it implies that he is acquainted with all known facts, as well as capable of applying them to discover new combinations, and to explain what has not before been observed.

What is styled hypothesis, is however, totally distinct from theory, and is liable to this reproach, for it is either founded on a partial view of facts, or has no other foundation, except that it is capable of explaining the phenomena which we observe.

In the course which I am now commencing, I shall find occasion to illustrate these modes of reasoning, and explain these processes further.

Physical Science is, then, built upon the foundation of innumerable experiments and observations, and is made up of propositions of different degrees of generalization. In the study of this science, it is by no means necessary to pursue in detail the methods by which it was originally formed. To enter into all the experiments, would occupy, not the duration of a single life, but of several; and some of the observations may be of phenomena so rare as to be repeated at intervals too distant to be seen oftener than once in the course of several generations. It is only necessary that we should have reliance on the veracity of the observer in the latter case, or have concurrent testimony in the former. Thus when Hally observed a comet in 1759, his observations were received to be true; others of a subsequent generation revised his calculations and predicted its return for 1835. Living astronomers therefore looked for it with complete faith. This faith was fully warranted by the exact coincidence of the re-appearance with the prediction. So also, to draw an instance from another source, when many nautical men have informed us that they have met, in the ocean, with an animal as large as a ship, we see no reason to doubt their joint evidence, and receive the existence of the whale for a truth as well established, as if it were derived from the evidence of our own eyes.

If, then, it be unnecessary for us to repeat the experiments and observations of others, provided the truth of their results be established by sufficient evidence: Of what use, may it be asked, is experiment in a course of lectures on the physical sciences? The answer to this question is important in the present instsnce, as it will elucidate the plan which it is proposed to pursue. Experiments, then, are of importance, and in some cases absolutely necessary, in a well conducted course of philosophical instruction: First, because they bring our analogical reasonings and mathematical investigations to the test of the phenomena themselves, and thus enable us to perceive whether we have included all the circumstances of the case: Secondly, because they enable us to illustrate general principles, by means of particular facts; and to describe the individual instances, whence the general laws are deduced; and, thirdly, because they impress upon the mind more firmly, the recollection of the principles which they are applied to illustrate. It is also to be stated, that they afford an agreeable variety, and thus render a study attractive, by giving pleasure to the senses, which, in their absence, might be dry and laborious.

Such, then, are the views with which experiment will be introduced into the present course. The manner in which the general principles that will be developed were originally discovered, will be described in the way of history, and reference will be had to the distinguished philosophers, who have been authors of the several discoveries. To these we shall appeal as authorities, not however to follow with blind obedience, but with due regard to the evidence of the authenticity of their statements, and to corroborating facts. This authenticity we shall test in individual cases by experiment, and thus show the truth of the induction, by the exhibition of a few of the facts whence it was originally obtained; at other times, we shall have recourse to experiment, solely as an illustration of the principles laid down, or for the purpose of serving as an artificial memory.

For such experiments, liberal appropriation has been made, and it is hoped, that by proper exertions, the course may be rendered not only instructive, but interesting.

Having thus explained the method by

which the principles of physical science are originally obtained, defined the value and use of experiment in a course of public lectures, let us return to the consideration of the class of existences, the examination of whose phenomena is the object of Natural Philosophy.

We have already seen the impossibility of lifting the veil which hides from us the agency of the Maker of "this universe and all created things," and of penetrating to the final causes which operate in the constitution of the substances and actions, which become known to us through the intervention of our senses. Failing in this, we adopt the method of defining the object of which physical science more especially treats, by its properties. Choosing for this purpose those, which by the method of induction, can be shown to be universal, and omitting every property which is not common to every part of the visible world.

The existences, then, which we include under the general name of matter, are marked by certain obvious properties which are common to them all. These essential properties are but two in number, and are known by the names of extension and impenetrability. By saying that matter possesses the property of extension, we merely mean, that it must occupy a portion of space in all the three dimensions of length, breadth and thickness. By impenetrability we express, that it is capable of occupying this portion of space, to the exclusion of all other material substances, or in other words, that no two portions of matter can exist in the same space, at the same instant of time.

From the fact that matter is extended, it follows that it is capable of being divided; and discussions have been entered into, for the purpose of examining how far this divisibility may be carried. It is sufficient for our purpose to state, that it is believed at present, upon a variety of concurring facts, that matter is by division finally resolvable into portions which are incapable of further division. This proposition is not however, susceptible of absolute proof, for the actual division, by mechanical, physical, or chemical means can be carried to such an extent. that the sight, even when aided by powerful instruments, can no longer follow the operation.

The ultimate portions into which it is believed that matter is finally resolved by division, are called atoms, or, in more familiar language, particles of matter. If it be true, that no two particles of matter can exist in the same space at the same time, it follows, that before any particle can enter and occupy the place possessed by another, the latter must be moved from that place. Mobility or the capability of being set in motion is therefore, although sometimes reckoned among the essential properties of matter, no more than a necessary consequence of its impenetrabity.

Attraction also, which is often classed among the properties of matter, is not essentially so, for we can conceive matter to exist without it, which is not the case with the other two properties which we have named.

When we cease to consider matter in the abstract, and view it as it presents itself to our senses, we find it existing under certain determinate forms, or in peculiar and well marked states of existence. To these determinate forms and peculiar states, we give the name of bodies.

Bodies, as we find them on the surface of the earth, are undergoing continual changes, although with different degrees of rapidity. Thus some small animals are born, enjoy the functions of life, and die, within a few hours; and no sooner has their life departed than a decomposition begins, which resolves them back again into inorganic matter. Other animals, and some productions of the vegetable kingdom, resist for centuries the attacks of death, but are finally made subject to the same general law. Even the most solid rocks yield gradually to the principle of change, and generations of them succeed each other in geological chronology, as those of men do in civil history.

In some cases, the disintegration is always attended by the destruction of the body, which the particles originally composed. Such is the case with all inorganic beings. But in the animal and vegetable kingdoms, although a waste of their particles is continually going on, this waste is supplied by the food which they consume, so long as the vital energy remains. In the youth of animals this supply exceeds the waste, and the body increases in bulk. In more advanced age, the waste and supply balance each other. Such is the extent of the change, which we are thus undergoing, that it has been proved by physiologists that at the end of seven years, no one particle which at the beginning of that period composed a part, even of our hardest bones, is left in the human body.

In all these changes, experiment and observation conducted with the nicest care, and strictest attention to weight and measure, have shown that not the smallest particle of matter is ever lost. It may be traced, forming in succession a portion of many different bodies, but in the innumerable changes of form, which proteus-like it undergoes, it still continues to exist, and to occupy its due extent of space, to the exclusion of all other material substances. The actions which we call natural, because they are due to causes inscrutable to us, operate with powerful, and in some cases, irresistible energy to produce changes in the constitution of bodies. We can ourselves, bring to operate on bodies mechanic forces, by which they may be rapidly disintegrated; and the actions of flame, of chemical affinity, and of other physical powers are still more efficaceous in changing the determinate forms in which matter exists at any given moment. But all these agents, natural, mechanical, physical or chemical, are wholly incapable of adding to, or diminishing in the least degree, the quantity of matter, which exists in the universe. Matter therefore, so far as any cause, which we can reach by our finite intelligence, is capable of acting upon it, is incapable of increase or diminution. It has therefore been inferred by some that it is eternal.

Persons of good intentions, but ignorant of physical science, have stigmatized the proposition of the indestructability of matter as Atheistic. So far, however, from being so, this very fact, is among the most powerful of the proofs of the existence of a deity, which natural theology brings to the aid of revealed religion. We cannot conceive of the existence of any thing without an adequate cause, and this truth is admitted under the name of the sufficient reason, both by infidels and believers. If then no finite cause be sufficient to generate material existence, it necessrily follows, that all which we see or discover by our other causes, in the universe, must be the work of an omnipotent cause,—the creation of an agent of infinite power. If his workmanship be eternal, so must he also be; and of his wisdom all nature furnishes abundant proof. If on the other hand the present state of things is ever to be brought to a close, it can only be so, by the same Almighty power, to which its original creation was owing.

The motion which bodies acquire, in consequence of the impenetrability of the matter of which they are composed, is subject to certain definite laws. The study of these, and the application of them to predict and explain natural phenomena, and to direct the works of human art, is the province of an extensive division of Physical Science, to which, from the intimate relation it bears to the practice of all the arts, the name of MECHANICS' has been applied.

Mechanics' differs from the other divisions of natural philosophy, in approaching more closely to the rank of an exact science. The laws which govern the action of the forces by which motion is produced are few; and are reached by the most simple induction. Upon these laws a science of vast extent and almost unlimited application, can be built by the aid of mathematical reasoning alone. So completely is the mode of proceeding identified with that employed in pure mathematics, that the original induction is often passed by unnoticed by such as content themselves with the mere theory. When, however, this theory is to be applied to practical purposes, innumerable experiments become necessary, upon friction, the strength of materials, the resistance of fluid media, and other interfering causes. Such however has been the extent of the researches into these subjects, and the accuracy of the mathematical laws which have been deduced from them, that it is hardly possible for a new case to occur in practice. We can calculate the power, and forsee the action of a machine, determine the proper dimensions of the parts of a proposed structure, or predict the quantity of water which will be delivered by a pipe, although miles from the source may intervene, with almost as much precision as we can estimate the number of square feet in the floor of a room.

Situated, as we are, upon the surface of a body which we call the earth, our position causes us to draw a wide distinction between the bodies which we find in our own immediate vicinity, and those which our sight teaches us, to exist in distant parts of space. The appearnces of the latter bodies, to which we have given the name of heavenly, are pursued by a species of observations which we style Astronomic. To the astronomy of observation it is necessary to call in the aid of mathematical calculation; and we obtain by their union the science of Theoritu and practical astronomy, the most elevated of those included under the general name of Physical.

The laws which govern the motion of the heavenly bodies, are shown by this science

to be identical with those which are involved in the motion of terrestial bodies. The motion of the ship upon the ocean, of the carriage upon the railroad, and of the manufacturing machine, are all subject to exactly the same rules as those which guide the planets through the regions of immeasurable space. When we apply these laws to the heavenly bodies, we create a science to which the name of celestial mechanics' has been given. This also goes in our language, although with little propriety, under the name of Physical Astronomy.

In the motions of bodies, in the changes which they undergo, and in some of their mutual actions upon each other, we perceive the influence of agents which cannot themselves be embodied or confined; and which therefore, although acting powerfully on matter, we cannot prove to be material. Among such agents are, heat, light, electricity, and magnetism. The investigations of the effects produced by them, and of the manner in which they act upon bodies, gives birth to a department of Natural Philosophy, to which the name of Physics is usually restricted.

The bodies which we meet with in nature are rarely simple in their constitution. Each of them is generally capable of being resolved into two or more other bodies of greater simplicity; and by means, whose manner of action we shall have occasion to study, bodies are finally reached, which it is impossible for us, in the present state of our knowledge, to simplify further. These simple bodies may again be re-united, and thus caused to regenerate the body whence they were originally obtained, provided it had not been organised. In the combinations which these elements thus enter into, they are found to be subject to a few determinate and definite laws. The study of these laws, and of the natures and characters of the substances themselves, is the province of another department of Natural Philosophy, which is known under the name of Chemistry.

Such then is the basis of the division of the general subject of Natural Philosophy, into distinct sciences. And it may not be amiss to repeat their names, along with a more brief definition, in order to impress them more fully upon the minds of such portion of the audience as has not yet entered upon the study of these subjects. The divisions of Physical Science, then, are:

1. Mechanics, which treats of motion in general, as well as of the construction of machines, and other artificial structures.

2. Astronomy, which observes the motions of the heavenly bodies, and by the application of mathematical calculation to the records of the observations, enables us to predict the occurrence of the several phenomena.

3. Celestial Mechanics, or Physical Astronomy, which applies the laws discovered in the motion of terrestrial matter, to the explanation of the phenomena of the heavenly bodies, and to the detection of minute variations, growing out of their mutual action, which can hardly be reached by observation alone.

4. Experimental Physics, which is generally restricted to the examination of the actions, and effects, of light, heat, electricity, and magnetism.

5. Chemistry which investigates the compositions of bodies and inquires into the nature and character of their elements, and of the several compounds which these elements make up. However different these subjects may be from each other, there is, notwithstanding, an intimate connection between them all, and it is indeed hardly possible to make progress in any one of them, without at least a partial acquaintance with each of the others. Nor is it practicable in almost any case, to produce a natural effect, in which actions which are included under at least three of the different heads, are not intimately connected. The three species of action which are thus closely allied, are the mechanical, the chemical and the physical. The agent, too, by which the motions of the heavenly bodies are controlled, is of the same general character as those we call physical; and were it not that we rather study it in its great mechanical effects, than in its mere laws, might be classed with electricity and magnetism.

A simple instance will serve to exhibit the connection, as well as to illustrate the difference, between these several kinds of action.

A smith places a piece of iron in his forge fire and heats it red hot; applying for the purpose the *physical* agency of heat. He next lays it upon his anvil and beats it into some proposed form, the action thus applied is strictly *mechanical*, not only in common, but also in scientific language. But while he beats the red hot metal, sparks fly off in all directions, which are the result of the combination of the iron with one of the component parts of the atmosphere, a combination which is therefore governed by *chemical* laws. We might go farther, and show how the combustion of fuel, urged by the action of a bellows, whence the heat is originally derived is due to another combination of mechanical, physical and chemical action, but what has been already said will suffice for our purpose.

It has already been stated that it is my intention to select from the wide field of which an outline has now been given, a few subjects susceptible of familiar explanation, and popular illustration. I have been farther guided in the choice of these subjects by the desire to exhibit those particular points in which Mechanics, Physics and Chemistry are more closely connected with each other. The course will commence with a general view of the classes into which bodies are divided, by means of their mechanical characters. Among these we shall find that the class to which the atmosphere which surrounds our earth belongs is the most curious and interesting. We shall therefore enter fully into the investigation of its nature, and mechanical properties. At every step we shall find that these properties are materially influenced, if not wholly due, to the physical agency of heat. The consideration of the effects of heat, and the laws by which it is governed, will therefore naturally follow.

Returning again to the atmosphere: its chemical character will be examined, and the manner in which it can be separated into a number of constituents, described. The most important properties of these constituents, and of the elements analogous to them in character will then be illustrated by experiment. In the course of these experiments, we shall be led to the consideration of the more important principles of physical science, and finally to the discovery of the laws of chemical affinity, with the consideration of which, the course will conclude.

It is hardly necessary that I should point out to this intelligent audience, the advantages to be reaped from the study of the physical sciences. Derived, as they are, from the careful observations of the action of nature, continued for several generations; and composed of laws and principles deduced by laborious study from innumerable facts, these sciences possess the merit of conveying to him, who wishes to enter into the practice of any of the useful arts, the accumulated experience of centuries. If therefore, it be not only possible, but a fact of daily occurrence, that a person, by practice alone may become eminent, in the manipulations of manufactures and the mechanic arts, he may save himself much labor, both of body and mind, by acquiring the principles of physical science, before he enters upon the manual part of his calling. These principles will enable him to foresee contingencies in the exercise of his art, which he might otherwise only learn by long and laborious experience. The difference in the progress of him who rests upon physical principles as the guide of his practice, and him who is unable to employ them, will be in some measure the same, as that which exists between the persons by whose researches the fabric of Natural Philosophy was erected, and those who study it in its present state. The investigations of the former have continued undisturbed, and in regular succession for more than two conturies, yet to a youth of intelligence and duly grounded in elementary knowledge, a couple of years may well suffice for the attainment of a complete outline of the sciences. The knowledge, too, which is acquired in the study of science, is capable of universal application, while that which is derived from practice alone, is of little value, except in the epecific case in which the experience was obtained. It is true indeed, that theoretic knowledge can never be a substitute for practical skill, but a far higher degree of that skill can be acquired, by him who is previously imbued with a knowledge of the physical science, than by him who is devoid of it. The cultivator of science and the practical man, ought therefore, in order to a complete success in their respective callings, to start from the same point. Both should be equally versed in the elements of natural philosophy. Their paths will then diverge from each other; the one will devote his whole time and attention to the increase of the facts of the science he studies or to the extension of its theoretic parts The other will apply the knowledge he has obtained to practical purposes.

Concluded in next Number.

WIDTH OF THE DELAWARE RIVER OPPOSITE PHILADELPHIA.—On the 17th of January, 1837, the river Delaware was carefully measured with a four pole chain, on the ice, from the end of the wharf at English's (late Daniel Cooper's) ferry, in

Camden, to the end of the wharf at Burr's (Blight's) ferry, south side of Market-st, in Philadelpqia, by Richard W. Howell, and Josiah Harrison, Esqrs., of Camden, and was ascertained to be 54 chains and 50 links, being 22½ rods short of three quarters of a mile.

M. Thenard has resigned the Professorship of Chemistry at the Ecole Polytechnique, and it is expected that he will be succeeded by M. Dumas.

Advertisements.

FRAME BRIDGES.

THE undersigned, General Agent of Col. S. H. LONG, to build Bridges, or vend the right to others to build, on his Patent Plan, would respectfully inform Railroad and Bridge Corporations, that he is prepared to make contracts to build, and furnish all materials for superstructures of the kind, in any part of the United States, (Maryland excepted.)

Bridges on the above plan are to be seen at the following localities, viz. On the main road leading from Baltimore to Washington, two miles from the former place. Across the Metawamkeag river on the Military road, in Maine. On the national road in Illinois, at sundry points. On the Baltimore and Susquehanna Rrailroad at three points. On the Hudson and Patterson Railroad, in two places. On the Boston and Worcester Railroad, at several points. On the Boston and Providence Railroad, at sundry points. Across the Contoocook river at Henniker, N H. Across the Souhegan river, at Milford, N. H. Across the Connecticut river, at Haverhill, N. H. Across the Contoocook river, at Hancock, N. H. Across the Androscoggin river, at Turner Centre, Maine. Across the Kennebec river, at Waterville, Maine. Across the Genesse river, at Squakiehill, Mount Morris, New-York. Across the White River, at Hartford Vt. Across the Connecticut River, at Lebanon, N. H. Across the mouth of the Broken Straw Creek, Penn. Across the mouth of the Cataraugus Creek, N. Y. A Railroad Bridge diagonally across the Erie, Canal, in the City of Rochester, N. Y. A Railroad Bridge at Upper Still Water, Orono, Maine. This Bridge is 500 feet in length; one of the spans is over 200 feet. It is probably the FIRMEST WOODEN BRIDGE ever built in America.

Notwithstanding his present engagements to build between twenty and thirty Railroad Bridges, and several common bridges, several of which are now in progress of construction, the subscriber will promptly attend to business of the kind to much greater extent and on liberal terms.

MOSES LONG.

Rochester, Jan. 13th, 1837. 4—y

ALBANY EAGLE AIR FURNACE AND MACHINE SHOP.

WILLIAM V. MANY manufactures to order. IRON CASTINGS for Gearing Mills and Factories of every description

ALSO—Steam Engines and Railroad Castings o every description.

The collection of Patterns for Machinery, is not equalled in the United States. 9—1y

TO CIVIL ENGINEERS, &c.

E. & G. W. BLUNT, 154 Water-st., corner of Maiden Lane, have recently received an assortment of LEVELS, from different manufacturers, among others from Troughton & Surins, which they warrant of the first quality. Circumferentors, Levelling Staves, Prismatic Compasses, Mathematical Instruments, Books for Engineers, etc., constantly on hand.

One of the above firm is now in England superintending the manufacture of Theodolites, Transit Instruments, etc.—and any orders for Instrumeats, not now on hand, will be forwarded him, and executed promptly 5—tf

STEPHENSON,

Builder of a superior style of Passenge Cars for Railroads.

No. 264 Elizabeth street, near Bleecker street, New-York.

RAILROAD COMPANIES would do well to examine these Cars; a specimen of which may be seen on that part of the New-York and Harlaem Railroad now in operation. J25tf

ARCHIMEDES WORKS.

(100 North Moor street, N. Y.)

NEW-YORK, February 12th, 1836.

THE undersigned begs leave to inform the proprietors of Railroads that they are prepared to furnish all kinds of Machinery for Railroads, Locomotive Engines of any size, Car Wheels, such as are now in successful operation on the Camden and Amboy Railroad, none of which have failed—Castings of all kinds, Wheels, Axles, and Boxes, furnished at shortest notice.

H. R. DUNHAM & CO.

4—vtf

AMES' CELEBRATED SHOVELS, SPADES, &c.

300 dozens Ames' superior back-strap Shovels
150 do do do plain do
150 do do do caststeel Shovels & Spades
150 do do Gold-mining Shovels
100 do do plated Spades
50 do do socket Shovels and Spades.

Together with Pick Axes, Churn Drills, and Crow Bars (steel pointed,) mannfactured from Salisbury refined iron—for sale by the manufacturing agents,

WITHERELL, AMES & CO.
No. 2 Liberty street, New-York.

BACKUS, AMES & CO.
No. 8 State street, Albany.

N. B—Also furnished to order, Shapes of every description, made from Salsbury refined Iron v4—tf

AN ELEGANT STEAM ENGINE AND BOILERS, FOR SALE.

THE Steam Engine and Boilers, belonging to the STEAMBOAT HELEN, and now in the Novelty yard, N. Y. Consisting of one Horizontal high pressure Engine, (but may be made to condense with little additional expense) 36 inches diameter, 10 feet stroke, with latest improved Piston Valves, and Metalic packing throughout.

Also, four Tubular Boilers, constructed on the English Locomotive plan, containing a fire surface of over 600 feet in each, or 2500 feet in all—will be sold cheap. All communications addressed (post paid) to the subscriber, will meet with due attention

HENRY BURDEN.

Troy Iron Works, Nov. 15, 1836. 47—tf

A SPLENDID OPPORTUNITY TO MAKE A FORTUNE.

THE Subscriber having obtained Letters Patent, from the Government of France, granting him the exclusive privilege of manufacturing Horse Shoes, by his newly invented machines, now offers the same for sale on terms which cannot fail to make an independent fortune to any enterprising gentlemen wishing to embark in the same.

The machines are in constant operation at the Troy Iron and Nail Factory, and all that is necessary to satisfy the most incredulous, that it is the most VALUABLE PATENT, ever obtained, either in this or any other country, is to witness the operation which is open for inspection to all during working hours. All letters addressed to the subscriber (post paid) will receive due attention.

Troy Iron Works, HENRY BURDEN.

N. B. Horse Shoes of all sizes will be kept constantly for sale by the principal Iron and Hard-ware Merchants, in the United States, at a small advance above the price of Horse Shoe Iron in Bar. All persons selling the same, are AUTHORISED TO WARRANT EVERY SHOE, made from the BEST REFINED IRON, and any failing to render THE MOST PERFECT SATISFACTION, both as regards workmanship and quality of Iron, will be received back, and the price of the same refunded. H. BURDEN. 47—tf

NEW ARRANGEMENT.

ROPES FOR INCLINED PLANES OF RAILROADS.

WE the subscribers having formed a co-partnership under the style and firm of Folger & Coleman, for the manufacturing and selling of Ropes for inclined planes of railroads, and for other uses, offer to supply ropes for inclined planes, of any length required without splice, at short notice, the manufacturing of cordage, heretofore carried on by S. S. Durfee & Co., will be done by the new firm, the same superintendant and machinery are employed by the new firm that were employed by S. S. Durfee & Co. All orders will be promptly attended to, and ropes will be shipped to any port in the United States.

12th month, 12th, 1836. Hudson, Columbia County State of New-York.

ROBT. C. FOLGER,
33—tf. GEORGE COLEMAN.

PATENT RAILROAD, SHIP AND BOAT SPIKES.

*** The Troy Iron and Nail Factory keeps constantly for sale a very extensive assortment of Wrought Spikes and Nails, from 3 to 10 inches, manufactured by the subscriber's Patent Machinery, which after five years successful operation, and now almost universal use in the United States, (as well as England, where the subscriber obtained a patent,) are found superior to any ever offered in market.

Railroad Companies may be supplied with Spikes having countersink heads suitable to the holes in iron rails, to any amount and on short notice. Almost all the Railroads now in progress in the United States are fastened with Spikes made at the above named factory—for which purpose they are found invaluable, as their adhesion is more than double any common spikes made by the hammer.

*** All orders directed to the Agent, Troy, N. Y., will be punctually attended to.

HENRY BURDEN, Agent.

Troy, N. Y., July, 1831.

*** Spikes are kept for sale, at factory prices, by I. & J. Townsend, Albany, and the principal Iron Merchants in Albany and Troy; J. I. Brower, 222 Water street, New-York; A. M. Jones, Philadelphia; T. Janviers, Baltimore; Degrand & Smith, Boston.

P. S.—Railroad Companies would do well to forward their orders as early as practicable, as the subscriber is desirous of extending the manufacturing so as to keep pace with the daily increasing demand for his Spikes. (1J23am) H. BURDEN.

RAILWAY IRON, LOCOMOTIVES, &c.

THE subscribers offer the following articles for sale.

Railway Iron, flat bars, with countersunk holes and mitred joints,

							lbs.	
350 tons	2½	by	¼,	15 ft	in length,	weighing	$4\frac{68}{100}$	per ft.
280 "	2	"	¼,	"	"	"	$3\frac{50}{100}$	"
70 "	1¼	"	¼,	"	"	"	2½	"
80 "	1½	"	¼,	"	"	"	$1\frac{25}{100}$	"
90 "	1	"	¼,	"	"	"	¼	"

with Spikes and Splicing Plates adapted thereto. To be sold free of duty to State governments or incorporated companies.

Orders for Pennsylvania Boiler Iron executed.

Rail Road Car and Locomotive Engine Tires, wrought and turned or unturned, ready to be fitted on the wheels, viz. 30, 33, 36, 42, 44, 54, and 60 inches diameter.

E. V. Patent Chain Cable Bolts for Railway Car axles, in lengths of 12 feet 6 inches, to 13 feet 2¼, 2¾, 3¼, 3½, 3¾, and 3¾ inches diameter.

Chains for Inclined Planes, short and stay links, manufactured from the E. V. Cable Bolts, and proved at the greatest strain.

India Rubber Rope for Inclined Planes, made from New Zealand flax.

Also Patent Hemp Cordage for Inclined Planes, and Canal Towing Lines.

Patent Felt for placing between the iron chair and stone block of Edge Railways.

Every description of Railway Iron, as well as Locomotive Engines, imported at the shortest notice, by the agency of one of our partners, who resides in England for this purpose.

Mr. Solomon W. Roberts, a highly respectable American Engineer, resides in England for the purpose of inspecting all Locomotives, Machinery, Railway Iron &c. ordered through us.

A. & G. RALSTON.

28 tf Philadelphia, No. 4, South Front st.

MACHINE WORKS OF ROGERS, KETCHUM AND GROSVENOR, Paterson, New-Jersey.

The undersigned receive orders for the following articles, manufactured by them, of the most superior description in every particular. Their works being extensive, and the number of hands employed being large, they are enabled to execute both large and small orders with promptness and despatch.

RAILROAD WORK.

Locomotive Steam-Engines and Tenders; Driving and other Locomotive Wheels, Axles, Springs and Flange Tires; Car Wheels of cast iron, from a variety of patterns, and Chills; Car Wheels of cast iron, with wrought Tires; Axles of best American refined iron; Springs; Boxes and Bolts for Cars.

COTTON WOOL AND FLAX MACHINERY,

Of all descriptions and of the most improved Patterns, Style and Workmanship.

Mill Geering and Millwright work generally; Hydraulic and other Presses; Press Screws; Callenders; Lathes and Tools of all kinds; Iron and Brass Castings of all descriptions.

ROGERS, KETCHUM & GROSVENOR
Patterson, New-Jersey, or 60 Wallstreet, N. Y
31tf